H. O. Lacount

Owing to War Conditions the September Convention of the Association will not be held.

Volume 32. JUNE, 1918. $3.00 a Year.
Number 2. $1.00 a Number.

JOURNAL

OF THE

New England Water Works Association.

ISSUED QUARTERLY.

PUBLISHED BY

THE NEW ENGLAND WATER WORKS ASSOCIATION,

715 Tremont Temple, Boston, Mass.

Entered as second-class matter September 23, 1903, at the Post Office at Boston, Mass., under Act of Congress of March 3, 1879.

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THE ASSOCIATION was organized in Boston, Mass., on June 21, 1882, with the object of providing its members with means of social intercourse and for the exchange of knowledge pertaining to the construction and management of water works. From an original membership of only TWENTY-SEVEN, its growth has prospered until now it includes the names of about **1 000** men. Its membership is divided into two principal classes, viz.: MEMBERS and ASSOCIATES. Members are divided into two classes, viz.: RESIDENT and NON-RESIDENT, — the former comprising those residing within the limits of New England, while the latter class includes those residing elsewhere. The INITIATION fee for the former class is FIVE dollars; for the latter, THREE dollars. The annual dues for both classes of Active membership are FOUR dollars. Associate membership is open to firms or agents of firms engaged in dealing in water-works supplies. The initiation fee for ASSOCIATE membership is TEN dollars, and the annual dues TWENTY dollars. This Association has six regular meetings each year, all of which, except the annual convention in September, are held at Boston.

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New England Water Works Association.
ORGANIZED 1882.

Vol. XXXII. June, 1918. No. 2.

This Association, as a body, is not responsible for the statements or opinions of any of its members.

STEAM PUMPING ENGINES.

BY ALFRED O. DOANE.*

[*Read February 13, 1918.*]

Among the earliest practical applications of steam power was its use in lifting water. Thomas Savery, in 1698, patented in England, a steam pump which consisted of a receiver to which steam was admitted. The valve on the steam pipe was then closed and water was played on the outside of the receiver, condensing the steam and producing a vacuum. The water to be lifted was forced by atmospheric pressure through the suction pipe and check valve into the receiver. Steam was again turned on and the water forced into the discharge pipe through a check valve by the steam pressure. This was a very wasteful engine, and, as boilers at that time could not be made to stand more than 15-lb. pressure, it could only raise water to a limited height.

James Watt, who was the first to apply scientific principles to the design of steam engines, invented, in the latter part of the eighteenth century, several types of pumping engines, both single and double acting, condensing and non-condensing.

The Cornish condensing pumping engine, used for unwatering the mines of Cornwall, employed steam expansively and was quite an efficient machine.

In this country, Henry R. Worthington invented the well-known Worthington duplex direct-acting pump. The water end of this pump is almost ideal in handling the water, as it starts the

* Div. Engineer Metropolitan Water Works.

column without shock, produces a uniform flow until the end of the stroke, and then gradually brings the water to rest. The steam end, however, is very uneconomical, as it is necessary to carry full steam pressure the entire length of the stroke in the high-pressure cylinders. By the use of compound and triple-expansion steam ends run condensing, considerable improvement in efficiency was obtained.

The duty developed by the compound condensing engine of this type ranged from 50 to 60 million foot-pounds per 1 000 lb. of steam. Many attempts were made to obtain the economy of the crank and flywheel engine and still preserve the favorable hydraulic conditions of the water end.

The compensators or tail pinchers of the Worthington engine operated by storing up power during the first part of the stroke under full pressure, by means of compressing air in cylinders attached to an extension of the piston rod; after cut-off, the stored power was released, and assisted the expanding steam during the remainder of the stroke.

In the D'Auria pump, an oscillating column of water was employed as a substitute for a fly wheel.

For many years duplex double-acting pumps were almost universally employed wherever water was raised by steam power. All the leading pump manufacturers made pumps of this type. The Worthington, the Blake, Knowles and Deane were leaders in this field. These pumps were of comparatively simple design, and were easy to operate and maintain. They were strongly built and were very durable. Many are still in use after thirty or more years in service, and many more have been replaced by high-duty pumps long before they were worn out. They are still used as fire pumps in many mills, being admirably adapted for this service where economy of steam is not essential.

The late Dr. E. D. Leavitt was one of the pioneers in this country in the development of the modern high-duty pumping engine. He designed a crank and flywheel pumping engine for the city of Lynn, which had a capacity of 5 mil. gal. per day and made a great reputation for economy, showing a duty of about 104 mil. ft.-lb. per 100 lb. of coal. This engine is still in existence, but is not in regular service.

Other notable examples of Dr. Leavitt's work are the two engines of the Metropolitan Water Works, — one of 20 mil. gal. daily capacity triple expansion, at Chestnut Hill Pumping Station; the other which was originally erected at the Mystic Pumping Station of the city of Boston and moved to the Spot Pond Pumping Station when the Mystic Water Works were abandoned in 1898. This engine is of the vertical compound type, having a capacity of 10 mil. gal. per day.

There is also a 50 mil. gallon Leavitt sewage pumping engine in service at the Calf Pasture Station of the city of Boston.

George H. Corliss, the celebrated engine builder and inventor of the well-known Corliss valve gear, built a high-duty compound condensing engine of 3 mil. gal. capacity for the city of Pawtucket, R. I., which developed the remarkable duty of 133 522 060 ft.-lb. per 100 lb. of coal.

The rapid growth of urban communities, the introduction of modern plumbing, and better fire protection, made insistent demands for more water at higher pressure, while the gradually increasing cost of coal and labor operated against the low-duty pump. Some of the large manufacturing companies engaged in keen rivalry, which resulted in a rapid advance in the size and efficiency of pumping engines.

The Edward P. Allis Company, now the Allis-Chalmers Company, built a number of vertical triple-expansion crank and flywheel engines, designed by Edwin Reynolds. The Milwaukee engine, built by this company and installed in 1886, was the first triple-expansion engine for water-works service, and showed a duty on 80 lb. steam pressure of 120 000 000 ft.-lb. per 100 lb. of coal.

The Holly Manufacturing Company, Henry R. Worthington, R. D. Wood & Co., Bethlehem Steel Company, Wm. Tod Company, and others, have built successful engines of this type.

At the Chestnut Hill stations of the Metropolitan Water Works there are four vertical triple-expansion crank and flywheel Holly engines, one of 40 mil. gal. capacity and three of 35 mil. gal. capacity; also one 30 mil. gal. capacity Allis engine of the same type. This engine held for some time the world's record for economy, with a test record of 178 500 000 ft.-lb. per 1 000 lb. of dry steam,

with a steam pressure of 185.5 lb. gage, and the head pumped against 140 ft.

The three low-service 35 mil. gal. capacity Holly engines tested together developed a duty of 157 349 000 mil. ft.-lb. per 1 000 lb. of dry steam, with a steam pressure of 150 lb. and a head pumped against of 45 ft.

The 40 mil. gal. Holly engine showed 175 066 000 ft.-lb. duty, with 152.1 lb. steam pressure and head of 132 ft.

With higher steam pressure and superheated steam, together with improvement in design, the duty of this type of engine steadily increased until in the case of the 20 mil. gal. Holly engine at the Bissells Point Pumping Station, St. Louis, a duty of over 202 000 000 ft.-lb. per 1 000 lb. of steam, with superheat of 100 degrees Fahr. and gage pressure of 160 lb., was reached.

Within the last three or four years the supremacy of the high-duty reciprocating pump has been challenged by the steam turbine driven centrifugal pumping unit. Great improvement in the design of both the centrifugal pump and the steam turbine and the development of an efficient and practical speed-reducing gear have made this result possible.

While the centrifugal pump has been used for many years, until recently its field has been limited to raising large quantities of water to moderate heights when economy of operation was not a controlling factor. The efficiency was low, averaging about 50 per cent., and most of the pumps were cheaply built for rough work. The modern centrifugal pumps show much higher efficiencies, ranging from 75 per cent. in medium sizes to well over 80 per cent. for the large pumps.

It is hardly probable that the mechanical efficiency of the water end of a centrifugal pumping unit can ever equal that of the best large reciprocating pumping engines, where the total friction loss as determined by the difference between the indicated and the water horse-power is sometimes not over five per cent.

While the high-grade steam turbine compares very favorably with the best reciprocating steam engines in economy, the lower efficiency of the water end is a handicap to the turbine driven centrifugal pumping unit.

The claim for consideration of this type of pumping engine does

not rely entirely on its steam economy, but rather on the lower over-all cost of pumping due to its comparatively small first cost, light weight, little space occupied, and less cost for supplies and attendance; resulting in smaller capital and depreciation charges on buildings, foundations and engines, as well as reduced operating expenses. The centrifugal unit may also be built of much larger capacity than it is practical to construct the reciprocating engine.

When comparison is made with large high-duty triple-expansion pumping engines, the increased fuel expense, larger boiler plant and higher labor and maintenance expense made necessary by the lower duty of the centrifugal unit should be taken into consideration.

In the case of increasing the capacity of an existing pumping plant, the turbine driven centrifugal engine has considerable advantages, as it may be installed in a small space, — perhaps between two existing engines, or in a basement where it would be impossible to get a reciprocating engine of equal capacity, — thus possibly avoiding an expensive addition to the building.

If the new unit is to be used principally as a reserve to take care of peak loads and emergencies, the case is still more favorable to the centrifugal, as economy of operation is not of paramount importance, while the lower first cost, small space taken up, and the short time necessary to start up from a cold condition make it an attractive proposition.

An article by G. H. Gibson, in the *Engineering News* of September 3, 1914, gives an interesting comparison of a 30 mil. gal. capacity steam turbine driven centrifugal pump, built and installed by the DeLaval Steam Turbine Company in the Kirtland Pumping Station of the city of Cleveland, with the 20 mil. gal. Holly engine at the Bissells Point Station at St. Louis, each engine holding the record for economy in its class.

	Kirtland Centrigufal Pump.	Bissells Point Triple-Expansion Engine.
Capacity, gallons per day	30 000 000	20 000 000
Total head, feet	206	288.3
Steam pressure, pounds, gage	150	160
Superheat, degrees Fahrenheit	100	100
Duty guaranteed, foot-pounds per 1 000 lb. of steam	136 500 000	195 000 000
Weight, including bed plates, tons	57	875
Space occupied, feet	35 x 7 x 18	30.5 x 22 x 51
Price of unit, including condenser	$35 750	
Price plus bonus		$103 953
Date tested	Dec. 30, 1914	Apr. 23–24, 1914
Delivery, gallons per day	30 300 000	20 610 000
Head, feet	236.3	297.7
Suction lift, feet	21.7	——
Steam pressure gage	153.85	159.43
Superheat, degrees Fahrenheit	102.6	105.23
Vacuum, inches	28.25	28.00
Boiler horse-power required	545.7	350.1
Duty developed:		
Foot pounds per 1 000 lb. of steam	152 020 000	202 628 616
Foot pounds per 1 000 000 B.t.u.	128 400 000	166 719 796
Water horse-power developed	1 257.0	1 074.91

From the foregoing data it will be seen that the price of the centrifugal unit is a little more than one third, the weight about one fifteenth, and the cubic space occupied about one eighth of the corresponding figures for the triple-expansion engine.

The DeLaval Company has made a comparison of cost of pumping by these engines, based on a coal at a cost of $1.69 per ton, and, assuming that the plants were constructed in the same locality, and that the cost of buildings, foundations, and boiler plants would be $36 371 for the centrifugal and $90 503 for the triple-expansion engine. All fixed charges, including depreciation, repairs, and fuel expense, are included, but no attendance or supplies, and operation at full load twenty-four hours per day and three hundred and sixty-five days per year is assumed. The resulting annual cost per water horse-power year is $23.11 for the centrifugal, and $27.68 for the triple-expansion engine.

The price of coal used was the actual price in St. Louis at the time of the trial. It has a strange look to us in this locality and

these troublous times, and it is hardly probable that such a low price will ever be seen again in any locality. With the normal coal prices which prevailed in Massachusetts before the war, the comparison would be in favor of the triple-expansion engine, under the conditions assumed.

Any comparison of costs based on prices which prevailed before the war is bound to be misleading, and the only way to get reliable information is to obtain actual estimates of cost from responsible manufacturers.

In comparing the relative advantages of the different types of pumps of the smaller sizes, say from 1.5 to 4 mil. gal. daily capacity, the centrifugal pumping unit comes into competition with the cross compound crank and flywheel reciprocating engine. The duties in this case are more nearly alike, while the advantages of weight and space occupied — particularly floor space — remain strongly in favor of the centrifugal.

The cross compound engine of this capacity will develop duties ranging from 115 to 135 mil. ft.-lb. per 1 000 lb. of dry and saturated steam, while the centrifugal unit may be expected to give from 85 to 95 mil. ft.-lb. on the same basis.

In comparison with the cross compound engine, the floor space occupied by the centrifugal is about one fourth, the weight about one sixth, and the cost in normal times, exclusive of foundations, about 60 per cent., for units of equal capacity.

It may be of interest to note some of the more important differences between these types of engine. The centrifugal pump operates by centrifugal force developed by whirling the water taken in at the inlet or eye by means of the rapidly rotating impeller, discharging it from the perimeter of the impeller at a velocity sufficient to overcome the head and other resistances pumped against. It follows that a given resistance requires a certain peripheral speed to overcome it. With constant speed if the head increases the flow diminishes, until the shut-off point is reached, when there is no delivery and the water is simply whirled around in the casing. If the head decreases, the delivery increases.

A gate may be shut on the discharge pipe while the pump is operating, without damage, if the water churning in the castings is not overheated by running too long in this condition. The

pump should be provided with a foot valve or check valve; otherwise the water will run backward through the pump when the power is shut off, causing the impeller to rotate very rapidly and perhaps cause some damage.

It is common practice, where the lift is high enough to require two-stage operation, to use two single-stage pumps in series instead of having two impellers in the same casing. By this arrangement somewhat greater efficiency is realized. Sometimes the pumps are connected so that both pumps may deliver at their rated capacity against a head suitable for domestic service; or by connecting them in series they may be made to deliver one half the quantity against double the head, for fire service. In some installations a low-service and a high-service pump are mounted on a common shaft.

The steam turbine as a prime mover has been in general use but a comparatively short time. The early turbines were generally of the single-stage type, and, as the velocity of expanding steam is about 3 000 ft. per second to the atmosphere, or 4 000 ft. to a high vacuum, and, in order to obtain the best efficiency the buckets of a reaction turbine should move at the velocity of the steam, while those of the impulse type should move at one half this velocity, the result was bucket speeds of 1 500 ft. per second in commercial single-stage turbines.

If the periphery of the impeller of a centrifugal pump should move at this speed, a head of 35 000 ft. would be generated. By applying the steam several times to the same wheel, or employing a number of wheels arranged in stages, the velocity of the turbine may be greatly reduced, but is still too high for satisfactory results with any practicable diameter of pump impeller if turbine and pump are direct connected.

The problem has been solved by the development of a practical speed-reduction gear, which enables the turbine and pump to operate at the speed best suited to each, under the given conditions. These gears, which are generally of the double helical type, must be made and fitted with the utmost care and precision, using only the very best materials.

The speed-reduction gears are perhaps the most difficult part of the centrifugal pumping unit to construct and maintain, and it

is very hard to construct them so that they will not make any objectionable noise, especially when the ratio of speed reduction is high. It is advisable to keep the turbine speed as low as practicable — not over 5 000 revolutions per minute for the small sizes and 3 600 for the larger ones. If all rotating parts are not in perfect running balance, or if the shafting is not in accurate alignment, serious vibrations may be caused.

The blades of the steam turbine sometimes give trouble by rapid corrosion, which generally reduces the efficiency. This is particularly apt to occur if there is excessive moisture in the steam, or with extremely high steam velocities. Trouble has also been experienced when using superheated steam, which sometimes causes the blades to crack and disintegrate.

The steam turbine is particularly fitted to utilize a high vacuum effectively, and for this reason should be provided with a high-grade air pump which should be of the independent steam-driven type, the exhaust from which may be profitably used to heat boiler feed water or may be put into an intermediate stage of the turbine and made to do useful work.

The high rotary speed of the shafting makes it very difficult to employ a mechanically connected air pump or feed pump.

In conclusion, it may be said that each type of pumping engine has its field of usefulness, and in selecting new pumping equipment the claims of each must be carefully considered from every angle, and the type selected which appears best suited to the conditions.

Discussion.

President Davis. We have listened to a very interesting and instructive paper, which is now open for discussion. I presume likewise Mr. Doane will be willing to answer any questions.

Mr. Frank L. Fuller. I think that this paper has been very instructive to us, and it calls to my mind that there are a good many situations where a centrifugal pump can be installed so that it will be very much nearer the water surface than the reciprocating pump could be on account of the smallness of its size and the smallness of the boiler, you might say, or the space taken up by it.

And it seems to me it is going to come, although its efficiency may not be as great as a triplex pump or a reciprocating pump, or other form. Still, taking into account the small space required, the lightness of the pump and its cheapness of price, it seems to me it is going to fill a place where it will be very desirable to install these pumps.

MR. J. M. DIVEN.* Do they offer any figures as to the comparative cost of operation?

MR. DOANE. I have not any figures of that kind, but perhaps our President could give us some.

PRESIDENT DAVIS. I can't give any figures from our experience, because the conditions are so varying. Sometimes the point where the turbine is put up, whether it is accessible or inaccessible — if it is inaccessible it may require the entire time of a man, whereas one man might operate two large pumps if close together. So many modifying factors come in that I do not believe, from my own experience at least, I could give any comparative figures of cost.

Mr. Doane spoke of the difficulty of maintaining gears. I have known of one or two cases where a very slight quantity of oil got into the water from the cooling box. And in those particular cases there were half a dozen nozzles spraying oil on to the gears, and the little drops of water which came in there through neglect — the men did not appreciate the situation — brought up a distinct line of heating in the gears directly under these nozzles. So that the elimination of little leaks is very important in connection with the gear question.

MR. F. H. HAYES.† Out in the Pennsylvania region of the big steel mills where they began using 4-, 5-,6-, and 7-stage pumps for their boilers, you will find that they are going back to the first principles of the outside packed pumps with compound steam ends. Centrifugal pumps without a steam turbine have to be fitted to the conditions as much as we do if we go to a tailor's shop and have a coat fitted to us. If we grow big, the coat doesn't grow big; if we grow small, the coat doesn't fit us.

Now, the argument has been brought out here to-day that the

* Superintendent Water Works, Troy, N. Y.
† Of the F. H. Hayes Machinery Company.

centrifugal pump occupies a lesser space. If you can pump more water with a pound of coal with a triple-expansion pump. I would say you were warranted in using that agency for the best interests of the people who buy it,— not for the house that surrounds it.

And I imagine that in less than five years, with all of the centrifugal pumps that are now in operation, we shall know more about them, for the reason that these things that we hear about them in regard to the duty being equal to the reciprocating pumps which should give just as good duty when two years old as when they were delivered. With the centrifugal pumps, if they have clear water, the life of the impeller is long; if they have dirty water, sometimes it goes to pieces very quickly. Any deterioration of impeller means loss of efficiency.

With a centrifugal pump there is no trouble in shutting up a valve in the discharge pipe.

But if a valve is shut up in the discharge pipe of a reciprocating pump, you will soon see what happens.

Let me recite a little condition which I know to be a fact, as I had to do with the putting in of a Duplex plunger pump. The water company had to furnish the locomotives of a railroad a great deal of water and the firemen are not careful in shutting the valves, with the result that, as they have so much water to handle, water-hammer develops in the pipes to a great extent; with the result that some one went to them and said they ought to use a centrifugal pump as it would stop the water-hammer. They did use a centrifugal pump and stopped the water-hammer, but it cost them fourteen dollars a day, to run it, more than the other pump did.

Mr. J. M. Diven. The old Worthington type of pump, giving 55 or 60 million pounds of duty, — a man would start his pump and fill up his oil cups and then perhaps go fishing after tending to his boilers. In fact, give the pump very little attention. You can't do that with the high-duty pump. This brings up the question whether there is not a point in small size where it does not pay to use a high-duty pump.

Mr. Doane. The firemen didn't have any vacation with those pumps you speak of. With the small pumps generally the en-

gineer was the fireman, and I don't see where he had any time to go fishing.

MR. DIVEN. Then you didn't have to have a fireman, the engineer could do both, which you couldn't in a five-million plant. Now, in that case you would have to charge up against the high-duty engine the salary of the fireman.

THAWING OUT FROZEN SERVICES.

BY D. A. HEFFERNAN.*

[*Read March 13, 1918.*]

Sunday morning, December 30, 1917, will not soon be forgotten by water-works men, as it inaugurated the most severe winter ever experienced by them. I have had twenty-eight years of service in the Milton Water Department and I never want to go through what I did during the prolonged cold spell, and I believe all superintendents feel as I do.

From December 30 to January 26, the Department worked hard and for ungodly hours, thawing out frozen services and removing burst meters, which we at first replaced with new meters until our auxiliary supply ran out and we began to see visions of having to purchase enough meters to reach a supply for three or four years ahead. From then on, we installed nipples in place of the meters. During this period, our thawing operations consisted of running a $\frac{3}{16}$-in. block-tin tubing through which boiling hot water was being pumped continuously into the service. This method proved entirely satisfactory during the first of the cold weather when services were freezing from the cellar wall out toward the street, but was not efficient when the frost had worked its way five or six feet into the ground, as it did in some places, and the services froze in the street.

The majority of the services laid to ordinary single houses fifteen or twenty years ago was $\frac{5}{8}$-in. lead, and it is impossible to push a block-tin tube, softened by hot water, to a great distance through small lead pipe laid without particular attention being paid to its straightness.

We have over 40 miles of services, and when you are told that they average 107 ft. in length, you may realize what a proposition we were up against when the services started to freeze in the street. They could not be reached with the thawing tube. In

* Superintendent Water Works, Milton, Mass.

the majority of cases, fifty feet of tubing could be pushed into the service without even reaching the ice.

When I found it impossible to cope with the situation with our own methods, I engaged an electric thawing apparatus. We began to use the machine on January 26, and from that day to the last day of February it was busy, under my personal supervision, which I knew was necessary from a financial viewpoint, as I had been through the mill in 1912.

For the benefit of those who have not seen this apparatus, I will give a brief description of how it works. It consists merely of a switchboard containing fuses, meter and switch, and a transformer and rheostat. It is necessary to take the current from the Edison primary wire carrying a voltage of 2 300. The current passes through the switchboard to the transformer, where its voltage is cut from 2 300 to 110, and from there to the rheostat which, in our case, consisted of a hogshead containing a solution of sodium chloride (common salt) and having a metal plate solid on the bottom and another plate which it is possible to raise or lower, as you desire less or greater amperage.

From the rheostat the current followed the secondary wire of 4–0 insulated cable which was clamped to the service pipe in the cellar of the house to be thawed, out through the service to the main, which it followed to the hydrant, to which the other secondary wire was connected; then back through this wire to the rheostat, transformer, switch, and finally to the primary again.

At first we went along swimmingly, cutting over secondary house circuits into primaries until the Edison Company woke up and forbade such operations. Thereafter, when primaries were not available, it was necessary to have a lineman make temporary installation of primaries, sometimes for a distance of eight hundred feet. The amperage used on different services varied considerably. Where long connections were needed, the greatest amperage we could get was sometimes only 150; at other times we used 500 amperes, while the ordinary amount averaged 350.

During thirty-one days, we thawed 140 services, of which 20 were private (being runs from a house to a stable, garage or greenhouse, and laid by the consumer) and for which we will make a charge,

4 hydrant branches, and a couple of short stretches of dead ends.

The average cost of thawing a service we found to be $12.46. Of course a short service cost considerably less, and the average was brought as high as it was because of the time consumed in the long jumps between jobs.

We were disappointed and discouraged several times when, a few days after thawing out a service, we received notice of its being frozen again. This we overcame by cutting a slot in the washer of one of the faucets, enabling a ¼-in. stream to flow continuously. Even at that, some consumers complained that what they considered undue noise got on the nerves of some delicately constituted member of the family, and to overcome it they put in a whole washer, with the result that they were again without water. We allowed these people to remain in that condition for a couple of weeks and we were not troubled again in that quarter.

After we had thawed a certain service out, we found the pressure to be considerably less than usual. A few days later a leak was discovered at the T. H. When this was dug up, we found a tail-piece melted. This was caused by the check nut having loosened somewhat, allowing an arc to make at that point and eating enough of the brass away to cause the leak.

We were unsuccessful at only one service. The current was brought from a distance of four hundred or five hundred feet. Neighbors were getting shocks from various sources. One man went to his cellar to shake the furnace and claimed he received a severe shock. Several others got it from faucets and telephones. There was a leakage somewhere in the ground, and the current did not reach the service to be thawed, but how it escaped, and where, we were unable to find out, even with the aid of a number of volunteer Sherlock Holmes amateurs.

However, on the whole, I found the electric thawing apparatus to be entirely satisfactory. It did its work quickly, cleanly, and cheaply.

Our average daily consumption jumped from 375 000 gal. to 500 000, during the period, as we had recommended every consumer to open one faucet enough to allow a ¼-in. stream to flow.

My estimate of the cost of the cold weather to the department follows:

Labor cost in excess of regular pay-roll	$847.29
Cost of electric thawing apparatus	1 472.23
Estimated cost of burst meters, 150 at $5	750.00
Excess of water consumed — 125 000 gal. daily for sixty-five days at $0.1336 per 1 000	1 085.50
Total	$4 155.02

From this must be deducted $545, to be charged against private work. It is not the intention of the department to charge the consumer for water used to prevent freezing, burst meters or thawing out, as they were not happenings caused by undue carelessness of the consumer. At the town meeting, an appropriation of $3 500 was granted to cover partially the expenses of the cold weather.

With 53 miles of mains, 40 miles of services, and 439 hydrants, I think you will all agree that Milton was very fortunate to get out of it as easily as it did.

Discussion.

Mr. Patrick Gear.* We had about 125 service pipes frozen in Holyoke. Ninety-two of these were thawed out with our own gasoline machine, by forcing hot water through block-tin pipe from the cellar to the main. Owing to conditions of some of the houses being built on terraces, others having elbows or offsets on the pipes, we were obliged to call upon the Gas and Electric Department to help us out with their electric appliance. The pipes that were thawed out by electricity were in different parts of the city, and in some instances it was necessary to run from 500 to 1 000 ft. of wire to get juice to thaw them out. Thirty-three services and four hydrants were thawed out by this process at a cost of $5.40 each, and the services that were thawed out with our own gasoline thawing machine and hot water cost $3.60 each. We are very grateful to the Gas and Electric Department for the assistance they gave us, and furthermore the pipes that were

* Superintendent Water Works, Holyoke, Mass.

thawed out by them we could not do unless we went to a much greater expense.

The people in our city were very considerate, and not any of them complained. They simply said, "Come as soon as you can, and we will try and get along the best we know how." I never thought until this winter that the people had so much sympathy for water-works men.

MR. IRVING S. WOOD.* Up to date we have had 4 950 cases of freezing. About 15 per cent. of our services froze up.

THE PRESIDENT. How did you thaw them out?

MR. WOOD. Both by steam and electricity. We had five electric gangs and a half a dozen steam gangs. I couldn't say how many pipes have been thawed out, and I guess nobody knows.

MR. WRIGHT. Up in New Hampshire, where I live, we have had some pretty cold weather, but out of 1 300 services we have only had 7 frozen.

MR. R. C. P. COGGESHALL. How about the snow?

MR. WRIGHT. We had a tremendous amount of snow.

MR. COGGESHALL. How was it in Holyoke, Mr. Gear?

MR. GEAR. We had plenty of snow, and if it hadn't been for the street railway company taking the snow off the street we wouldn't have had any trouble with freezing at all. It was only where the street cars ran that we had any trouble.

MR. FRANK A. MCINNES.† I agree with you, Mr. President, that there must be a lot of information obtainable on the subject of frozen pipes. If it were not for the great war which overshadows everything and makes us minimize our difficulties, the experiences of this past winter would have been considered in the light of a calamity, because of the serious trouble and damage to health and property due to frozen water pipes. We have been doing all sorts of things. We have been using alternating current through a transformer and rheostat, and direct current through a rheostat, and we have been making large use of storage batteries. We have gained a lot of experience, as everybody else must have done. Wouldn't it be wise to appoint a committee to get together the experiences of our members? We will probably not

* Civil Engineer, Providence, R. I.

† Boston Water Department.

have another winter like this for a long time; there has been nothing like it since 1874–75 in Boston, with the same condition of early and continued cold without snow, and it is a glorious opportunity to find out what has been done. I should like to see a committee appointed for that purpose, provided I am not made one of the committee.

A MEMBER. I should like to ask those who have been thawing with electricity if they have had any difficulty where leadite or hydrotite has been used as an insulator.

MR. HENRY A. SYMONDS.* I think that our experience this winter has shown that it is almost impossible to thaw out water pipe through a great number of leadite or hydrotite joints. We tried to use an electrical thawing apparatus on one system where all joints are of leadite, and had to abandon it after a short time, except for use in thawing from the service box to the house. Where there were more than three joints, we found it was difficult to thaw the pipe by electricity. In another plant where we had similar conditions, except that one half of the joints were lead, we had no trouble whatever in the lead section in thawing everything with the electrical device, but we abandoned its use as soon as we began on the leadite section. Composition joints are unfavorable for thawing frozen pipe with electricity, but prove excellent as a preventive of electrolysis.

MR. COGGESHALL. I will tell you one experience we had, in trying to thaw out a pipe on a large main. We couldn't get any current through it, and then our foreman happened to remember that an insulating joint had been placed there to guard against electrolysis. So he shifted the connection to avoid that, and then was able to thaw very quickly.

MR. FRANK L. FULLER.† We have about 1 700 services at Wellesley, and about 150 froze. The original pipe was covered about 4 ft. 9 in., and I presume additions that have been put in since have been about the same depth. I think the service pipes are down probably about 5 feet.

MR. GEORGE A. KING.‡ In two sections of our city, on two

* Civil Engineer, Boston, Mass.
† Civil Engineer, Boston, Mass.
‡ Superintendent Water Works, Taunton, Mass.

streets, eight or ten service pipes were frozen on one side of the street and none on the other.

MR. FULLER. How about the sun?

MR. KING. One street ran northwest and southeast, I should say, and the other ran very nearly east and west.

MR. A. R. HATHAWAY.* I had hoped that to-day I might get some information to carry back home with me, in regard to a question which Mr. Heffernan has touched upon in connection with this matter of frozen services, resulting from the abnormal frost conditions this winter. The information wanted is rather from the office point of view than from the superintendent's or the work side.

In Springfield we have had about eight or nine hundred services frozen in the street, besides about a thousand meters frozen, but practically no mains. With our limited means of thawing out the services, — which we attempted in the order in which they were reported, — many consumers were out of water, and while waiting their turn we tried to supply them to a limited extent by sending around water-carts of the street department. As fast as the pipes could be thawed out, the consumers were requested by the superintendent's men to let the water run to prevent a recurrence of the freezing in the street. Where meters were frozen they were taken out and stored in the shop, waiting future opportunity for repairing them. I should like information as to how others will treat the excess registration by meters left in, where such excess is caused by letting the water run by request of the superintendent's men. Six years ago we had a similar experience, but to a much smaller degree, and the water board at that time authorized the policy of making the ensuing bills for the normal amount which would have been naturally registered under ordinary conditions, and charging the excess consumption to a special expense account. I don't know how the matter will be treated this year, but the water board has directed that all bills be made for whatever registration is shown, where the meter is left in, and let the consumers present their requests for abatement, with their reasons therefor. These requests are to be held and accumulated until a special meeting is called for the purpose,

* Water Registrar, Springfield, Mass.

when each request will be individually considered and a policy probably adopted.

Besides the foregoing class of cases, we will have another class, where consumers have let the water run without such request or authority from the superintendent's division, fearing trouble in their service, and probably claiming that their action will have saved the water works from similar expense of thawing out in the street, or carting water to them.

A third class or group of consumers are already requesting consideration and remuneration of expense incurred by their employing plumbers to thaw them out in the street, stating that they could not wait for the city to do the work, and of course we have much sympathy for them.

These three different classes of claims are coming up for consideration in Springfield, and so I should like to obtain some expression of opinion from the members present, as to the probable policy others will adopt, or which may already have been adopted.

THE PRESIDENT. This is an interesting question, and opens up a wide subject for discussion.

MR. HATHAWAY. I have already sent out a questionnaire, or letter, to some seventeen different water works, stating the circumstances and asking for an expression of opinion and description of experience. I have had several interesting replies already, and any information and expression I might be able to obtain here will be of great help to our water board, and such interchange of opinion I am sure will be beneficial to all.

THE PRESIDENT. What has been the nature of the replies you have received?

MR. HATHAWAY. I have received three replies up to this time. I remember that in one of them the ground was taken that the consumers should bear their portion of the expense due to the abnormal conditions, in the same manner that the water works has to bear its proper proportion. In other words, neither the consumers nor the water works is to blame for such conditions, and therefore should share the burdens alike. Another reply stated that a policy would probably be adopted of allowing a fifty per cent. discount on the excess registration due to letting water run to prevent freezing. In Springfield we have always

allowed no abatements on metered water bills, except in cases where excessive bills were caused by so-called blind leaks in underground or hidden piping, and in such cases the excess was divided with the consumer, where the trouble was found and promptly remedied.

MR. A. E. MARTIN.* We have had in Springfield between one thousand and twelve hundred frozen meters, and something over eight hundred frozen services, and this in spite of the fact that for the last fifteen years at least we have been placing our service pipe 6 ft. in depth, and our mains are laid with $5\frac{1}{2}$ ft. cover. We have had only one frozen main, and that didn't give us any trouble. We had three hydrants whose branches were cut off as clean as though they had been cut with a knife or a saw. Our theory about that was that it was due to the lifting of the hydrant by the frost. In one case we shall have some damages to pay on account of water getting into some of the cellars and into an electric light conduit, causing about six hundred dollars', worth of damage.

The services were thawed mostly by hot water with a block-tin pipe and force pump. Only about twenty-five per cent. of all we had frozen could be reached by the electric current which we got from the electric company, they furnishing our men with a transformer and we buying the wire and all the appurtenances. Where we could use the 2 300-volt current they charged us $1.50 for the electricity consumed, and 75 cents where we used the 110-volt house current. I can't tell you what the cost of thawing our services has been, because it hasn't been figured up as yet; but I wouldn't be at all surprised if the expense due to the calamity, if we may call it that, will total close to ten thousand dollars. The expense of repairing meters will be charged to the consumers for they were practically all in houses where they should have been taken care of. We made no charge for thawing the services, and, as Mr. Hathaway says, the question of charging for the water is for our board to decide.

MR. MCINNES. We have found the storage battery most satisfactory. It is flexible and does not depend on a wire in the street, but, of course it has its limitations, the same as any other

* Superintendent Water Works, Springfield, Mass.

method. And that is why I should like to have a committee appointed to collect all this information.

THE PRESIDENT. You make that as a definite motion, I take it?

MR. MCINNES. Yes, I do.

THE PRESIDENT. If the members are reluctant to discuss Mr. Hathaway's inquiry now, I suppose that the scope of the committee could be broad enough to take in a consideration of that question.

MR. HATHAWAY. I thought, when Mr. McInnes was making his motion, that that would be a very proper thing to be included in the duties of the committee, and if we could have a report which would suggest a policy to be followed in the future I think it would be very useful.

MR. MCINNES. My primary object was to have the committee investigate and report so that our members next winter would know what is the most efficient and economical means of thawing pipes. I shouldn't like to get away from that, but I see no reason why the other could not be covered as well.

MR. HATHAWAY. In talking with one of the members to-day, about this matter, he suggested that meters might have been all left in, where services were frozen and thawed in the street, and the tenants told to let water run; thus getting a registration of excess used for the purpose, which might properly be called an expense chargeable to the water works. But other consumers, who might not have had their services frozen, and had not been told to let the water run, might also have let the water run upon their own responsibility, and, as their meters would not be off for any purpose, the excess would be charged to them, although possibly the water works may thereby have been saved trouble and expense from their services not freezing. In these two cases, one consumer might have to pay for such excess and the other might not. If I were one of the latter class, I should object to paying for the excess. So I think the better way would have been to take off the meters where such trouble had occurred and leave them off until all danger had passed.

MR. HEFFERNAN. The frost in Milton is down five feet, and we have recommended that the consumers keep their water running to prevent the pipes from freezing, the department to make

proper adjustment for all excess water above the normal consumption. In taking several readings of the temperature of the water supplying the extra high service in the Brush Hill section we found it extremely low, the average being 34 degrees. As my department has been very fortunate as far as breaks are concerned, and therefore having done no excavating, I made several inquiries relative to frost conditions nearby, and was informed that the frost was gradually working away from the pipes. If any member can give me any further information along this line I shall greatly appreciate it. As conditions seem to be now, it will probably be April 1 before we shall notify consumers to stop running the water.

THE PRESIDENT. I want to be sure that Mr. McInnes makes his motion and that it is properly seconded, so that a committee may be appointed, because I think that is very important.

MR. GEORGE F. MERRILL. I will second the motion.

MR. MCINNES. My motion was that a committee be appointed to report, not later than at the annual convention, in regard to the general subject of thawing frozen water pipes. That is the motion as I had it in mind originally, but I should be very glad to have any amendment made to it.

THE PRESIDENT. We will assume that the motion made is amended so that this committee can take up collateral subjects, such as Mr. Hathaway proposes.

[The motion is adopted.]

THE PRESIDENT. I don't think I can appoint the committee without further thought, for this is an important matter and we want to be sure that the gentlemen appointed on the committee will have time and disposition to work on it and be ready to report at the annual meeting. I will announce the committee later.

A MEMBER. Speaking about the temperature of water I will say that for about two weeks the temperature of the water in our mains was 32. It was really liquid ice; there was no difference between ice and the water, except in form. I should also like to express the opinion that part of our trouble this winter has been due to lack of rainfall during the fall months. Frost seems to penetrate dry ground deeper than it does wet ground. In wet ground there is the latent heat of the water which acts to retard the progress of the frost.

MR. FRANK E. MERRILL.* Ihave understood that the water entering the mains from the Metropolitan reservoirs has been just above the freezing point. Perhaps Mr. Killam can tell us about that.

MR. JAMES W. KILLAM.† The water has been very cold. We have done the best we could, but the ice has been very thick in the reservoir, and the large quantity of water used made it necessary to take the water directly from the reservoir. The temperature has varied from about 34 up during the coldest spell.

*Water Commissioner, Somerville, Mass.
†Superintendent Metropolitan Water Works.

THE BUILDING OF CAMP DEVENS.

[EDITOR. — We regret not being able to publish in this issue of the JOURNAL an article by Mr. Frank Barbour, embodying the substance of the very interesting address on the building of Camp Devens, given before the Association at the March meeting.

Unfortunately, shortly after reaching California, — whither he went with Mrs. Barbour, in search of much-needed rest, — Mr. Barbour came down with a severe attack of pneumonia, lay at death's door for some days, but is now happily on the road to recovery.

Mr. Barbour's address was followed by discussion by Mr. Leonard Metcalf and Mr. George W. Fuller, which are here given.]

MR. LEONARD METCALF. There are a few words I should like to say in simple recognition of the wonderful work done on this cantonment construction by its builders, as by other men on other cantonments.

When you stop to think that six months ago there was no organization to do this work, — because the Engineer Corps, to which it would have been entrusted, was so small that it could not do more than the work to be done in France, — and that in that period of time there has been built up in Washington an organization of about 350 men, and at the cantonment sites organizations involving about 200 000 men, which have built these camps at a cost of from eight to ten million dollars each, and that the whole work has been done at cost plus a profit of approximately one and a half to two per cent. to the contractors, I think you will say it is a record without parallel.

The form of contract provided for a sliding scale of profit — it was known as the " emergency contract " — the work to be done at cost plus profit, the scale of profit running from ten per cent. to seven per cent., depending on the magnitude of the work, and with the very important limitation of an up-set profit of $250 000 to the contractor. Out of that profit had to come the contractor's overhead, which I believe has been about $100 000. I know at one of the camps it was about $80 000; at another one of the camps,

something over $100 000; and, I believe, on a third camp about that sum. Moreover, there had to come out of it the contractor's interest costs, which probably have amounted to from $25 000 to $40 000. So that out of the nominal profit from these 16 cantonments, which will involve a cost of $134 000 000, the nominal percentage profit of three per cent., corresponding to $250 000 at each camp — is cut to about two per cent. or somewhat less. And, mind you, these contracts were taken by the contractors with the understanding that the work involved would cost from three to perhaps four million dollars, while as a matter of fact they have done from eight to ten million dollars' worth of work without any increase in the estimated profits or the allowance to them. I think this is a most inspiring record.

Two or three references will give you an idea of the magnitude of the task before the Government. These 16 cantonments will involve a cost of about $134 000 000. They involve 26 500 buildings. They have involved the shipping, as shown by Washington records, — though there were many additional cars of which it did not have record, — of 77 000 carloads of materials — or 112 000 if you include also the National Guard camps, of which there were 16, which will involve an additional cost of about $36 000 000. The contracts, as Mr. Barbour stated, were let at varying dates from the middle of June to July 6, I think; and on September 5 or 6, after two months and a half at most of active construction, there could have been housed practically two thirds of the quota of men, or, in other words, about 450 000 men out of the 650 000 that the cantonments were to house; and they were substantially completed on December 5, or within six months' time.

With regard to the work at the various cantonments, it has been a work of good team play. The contract was of a form which made it possible to have good team play, prompt decisions on the ground; and when you get a combination such as we had at Ayer, — and I say "we" as representing the public, — with Captain Canfield — now Major Canfield — commanding quartermaster, Mr. Barbour in charge of the engineering work, and Fred T. Ley as contractor, you get a combination that can do almost anything, gentlemen. The record that they have made for them-

selves and for the Government is a wonderful record, deserving of the highest praise.

Now I come to the question of wastefulness. Various things have been said in the papers. For instance, when I was in Washington there were reports from some of the southern camps that lumber was costing sixty dollars which could be bought for twenty dollars odd, and that labor was being paid similarly high prices. Those reports were not true. Lumber was then being bought by the Government cheaper than it was being bought by private concerns or corporations, and certainly at prices which were absolutely fair to the Government, due to the work of the various committees of the Council for National Defense. For instance, in one case, which I chanced to have inquired into, the lumber was being bought for about $22 in the South, with from $4 to $5 railroad charges to be added, or at one half of the retail price referred to in the criticizing article.

This cantonment work was done by the building up of an organization to assist Brigadier-General Littell, — then Colonel Littell, — of the U. S. Quartermasters Corps, who was put in charge of the management of construction by authority of the Secretary of War, and he was given authority to report directly to the Secretary instead of having to report to the chief of his Department and he in turn to the Staff, which would have delayed the work very materially. Colonel Littell was assisted by two officers chosen by him, — Major Oury and Major Marshall, — Major Oury having charge of the enlargement of the existing works and assisting also in this new work, and Major Marshall being the more active of the two on the new construction. Major Oury has since been drawn into other work, and Colonel Marshall is now in command, Colonel Littell having been retired as a brigadier-general.

Under this military head an organization of civilians was drawn together, some of whom had had military experience. Major Gunby of this city, — one of Mr. Charles T. Main's partners, — was put in charge of design — a very happy choice, as it proved, because he is not only an exceedingly competent man but has a very happy faculty of getting along with men and getting work out of them. He has a very keen sense of humor and is an

indefatigable worker. Major Hamilton, purchasing agent of the Stone & Webster organization, who gave up his work to take up this governmental position, was placed in charge of materials and transportation. The construction work was in charge of Major Whitson, one of the junior partners of Grant, Smith & Co., the contractors, of New York, St. Paul, Seattle and elsewhere, one of the largest firms of contractors in this country. And the accounting work was in charge of Major Dempsey. Naturally, the organization has gone on increasing, so that the division now comprises about 350 men.

A committee of the National Council for Defense, under the Munitions Board, — of which Frank M. Scott, of Cleveland, was the very able chairman, — known as the Committee on Emergency Construction of Buildings and Engineering Construction, acted in a purely advisory way to General Littell, and suggested this organization which was subsequently appointed by him from civil life. This committee attempted to fill the gap between the time of his appointment and the time when the appropriation bill might be passed by Congress, for at that time General Littell had no funds, no personnel, no place even in which to work, and with the construction of millions of work, in so short a period of time as from three to six months, it was obviously necessary to save every day which could be saved.

This civilian committee consisted of William A. Starratt, of New York, formerly of Thompson, Starratt & Co., chairman; Mr. M. C. Tuttle, of this city, whom most of you probably know as secretary of the Aberthaw Construction Company; Mr. Lundhoff, a contractor of Cleveland; Mr. Frederick Law Olmsted, the landscape architect and engineer of Brookline; and Major Kelley, of the United States Engineer Corps, who was not, however, able to give much time to the work.

That committee in turn appealed to various individuals to assist in this work; and it was in this way that Mr. George W. Fuller, of New York, and I happened to be drawn into the work. We were mere subcommitteemen, doing what we could to help, through our knowledge of engineers and contractors in the country. The principal work — I cannot speak of this at length for lack of time — which that committee did was, first, to send out compe-

tent engineers to the sites, as they were chosen by the Army Staff, to make the necessary surveys and study the topography, the water supply, the sewerage and railroad facilities, and so on. That work was taken up and done virtually before the appropriation bill was passed by Congress, without funds, without any assurance that the Government would pay for it, through the voluntary services of men who were the leading men in their respective professions in the several sections of the country involved.

Then the committee took up the question of the form of contract. It was obvious that the ordinary Government method, of competitive contract, was out of the question because of the lack of time and of the fact that a contractor, facing the uncertainty of the labor market and the uncertainty of his ability to get materials, would have had to increase his bid to such an extent as to involve a very serious increase in cost to the Government. There were considered, then, these alternative forms of contracts, lump sum profit and a percentage profit. The former was given up because of the fact that it was believed that it emphasized more the question of the amount of money involved than the fitness of the individuals to do the work, and that it would not result in any cheaper construction than the percentage contract with an up-set limitation in profit. In other words, if the lump sum basis had been selected it would have been difficult for the Government to have taken what it believed to be the most competent man to do the work, if a number of other men had offered to do the work for a less sum.

The committee, therefore, prepared this form of contract, which was known as the "emergency contract," providing for cost, plus a sliding scale of profit depending on the magnitude of the work, with an up-set limit in cost. It did this work with the assistance of many able men, lawyers, engineers, administrators, Government officials; and the form of contract was finally adopted by the Secretary of War and used by General Littell in the work.

The next thing the committee did was to investigate the question of available contractors. Questionnaire letters were sent out to fifty of the leading trunk-line railroads, eighty of the leading engineers and architects of the country, and to various govern-

mental bureaus, and personal telegrams were sent to men who might know about the most available persons. From the results of that call, lists of available firms were prepared, and then there were obtained the records of the contractor's work, the men whom they had handled, the men whom they had fed in camp, the millions of work done and the character of the work done in the last two or three years; and I assure you it was a most inspiring list. We would have had no difficulty in selecting one hundred contractors who could have handled millions of work for the Government in the course of twelve months' time. I think it was a surprise to all of us.

The designation, when the camps were located, of the most desirable contractor to do the work was made by a subcommittee of five, who reported to the Munitions Board, that is to Mr. Scott's committee, which committee then made recommendation to General Littell. General Littell took the recommendation to the Secretary of War, the Secretary of War then passed upon it, and finally General Littell made the appointment. In that way the Government had the benefit of the advice and the suggestions of these bodies of men representing these two committees, and was perfectly free to act as it saw fit on the best information available to it. As matter of fact, the contractors designated were appointed in substantially every case. I think that the construction of the camps has justified the choice and that the contractors chosen have made a splendid record for themselves.

The committee then took up the question of the personnel of the engineer corps to build the various camps, and suggested to General Littell's department the men it thought available at the moment to take up the work, and the appointments were subsequently made by General Littell, of the engineers in that way. It was in that way, for instance, that Mr. Barbour was appointed, the whole theory being to appoint the most competent and available men at the time for the work, men whom it was believed would work well together, so that the Government would get good team play, and then giving them a free hand to do the work on the ground. The work was in fact done in that way; Mr. Barbour, for instance, called to his assistance various men to take charge of the various branches of the work, — the water supply, the roads,

sewers, steam plant, and so on, — so that he had a corps of 140 men at one time on his engineering staff. The accounting force was appointed in a similar manner. Suggestions for the latter were made by the Advisory Committee, and the appointments were made by General Littell with the assistance of Major Dempsey, and the accounting force ranged from perhaps 75 to 125 men at the various camps.

Various issues came up in regard to the form of contract. Effort was made to so arrange the method of approving and paying for the work to reduce the difficulties in getting the pay-rolls through promptly, so that the carrying charges should not be unduly burdensome to the contractor. It was very difficult to get concession to this end from the Government. For instance, it was suggested that in view of the dilatoriness of the Government, or from lack of personnel to pay promptly, it would be equitable to allow the contractor interest on the carrying charges. The instant reply was that that would set such a dreadful precedent for the Government that it would cost it millions or billions hereafter, and was not to be thought of. So the unfortunate contractor had to bear that burden. But, on the other hand, every possible effort was made by the comptroller of the currency — who is the final dictator in the Treasury Department — to arrange for the corps of accountants to make the payments as rapidly as possible. But there was required by the contractors at the various camps a working capital of from $750 000 to $1 000 000 to execute their work, which became a burden of expense to the contractor through the fact that the bills were not always paid promptly when they were due.

Just one thing more in closing, to meet the idle comments and criticisms made by thoughtless persons in the press as you hear them from time to time. Bear in mind that this wasn't, and in the very nature of the case could not be, a sandpapered job, and that it could not be done with the same finish and care which would have been exercised if two years could have been taken to build it, instead of only from three to six months. It was a saving *not in cost, but in time and in lives; in the highest sense, an economical procedure;* because you will realize, when you stop to think of it, that if the contractors had been limited in what should be paid

for wages, to what should be paid to a permanent force, for instance, it would not have been possible to have gathered together in so short a time an organization of 10 000 men such as there was at Ayer. What was paid for labor was the ruling wage in the several communities in which the camps were built, and that meant the ruling wage for an eight-hour day, with time and a half or double time for excess time. And no amount of explanation would have helped the situation if the contractor had failed to complete the work promptly. Delay in this work, even though it had resulted in some saving of cost here, would have involved millions of loss abroad in this interval, which would have meant that additional months would have been spent on the firing front and additional thousands of lives would have been lost. So it seems to me that the proper perspective, the proper point of view, is that the work was done with a view to saving time, to getting the work done as quickly as possible, that men might be trained in these camps as soon as possible; and that was accomplished.

Mr. George W. Fuller. *Mr. President and Gentlemen,* — I am very glad to have heard Mr. Barbour's address to-day. I am still more glad to pay tribute to the splendid work which he has done for his country, both as a man and as an engineer. It is a simple statement when you hear it said that some six or eight million dollars have been spent in three or four months, but what that means is something that very few, if any of you, really know. The strain which it has meant, physically and mentally, from the standpoint of all the engineering skill at his command, is something which makes me feel very proud of Mr. Barbour, and very proud, also, of what water-works men have done generally in this great response which has been given to the call for help in putting the conscripted men quickly into the cantonments. I am very glad to say I feel just as Mr. Metcalf does about this whole matter, that it has been a very wonderful success in a very large sense of that word. I believe the way that water-works men have been responsive to the demands quickly put upon them at all these cantonments and National Guard camps is a splendid tribute to their loyalty and ability.

The hour is late, and I am not going into details. I simply am very glad to say a word about the splendid work which Mr.

Barbour has done, and I think it is work which has been unsurpassed at any of the cantonments. It is work which was done quickly, and I believe that it was done in the face of difficulties as to topography, wooded area, etc., which have put a great deal more of a demand upon the resources of the men in charge than has been the case at some of the other sites.

RECENT LEGISLATION AND DECISIONS OF THE COURTS WITH REFERENCE TO THE SANITARY PROTECTION OF WATER SUPPLIES.

BY ALBERT L. SAWYER*

[*Read March 13, 1918.*]

A case prosecuted last year by the Haverhill Water Board, in their endeavor to secure the sanitary protection of the water used by the city of Haverhill as sources of water supply, may be of interest to the members of the Association, especially as it involves a decision of the Supreme Court of Massachusetts affecting the right of the State Department of Health to delegate its authority and of the Water Board to withhold permits, the Court further ruling that the enforcement of these regulations was neither arbitrary nor unreasonable.

Although there have been many decisions made in favor of the State Board in specific cases, this is the first time, I believe, that the right of the board to delegate its authority has been passed upon, and it is considered a most important decision by the State Department of Health, and will doubtless lead to a more vigorous enforcement of rules by many water departments.

The city of Haverhill obtains its water supply from five lakes and ponds and a storage reservoir, all but one situated within the city limits. The approximate distances of these ponds from City Hall is as follows:

Lake Saltonstall	one mile
Round Pond	one mile
Kenoza Lake	two miles
Johnson's Pond	three miles
Millvale Reservoir	three and one-half miles
Crystal Lake	five miles

At the request of the Water Commissioners, the State Department of Health in September, 1901, set forth rules and regulations covering Kenoza Lake and Millvale Reservoir, and in February, 1912, similar rules covering the other ponds. Since this latter

* Water Registrar, Haverhill, Mass.

date, all boating, fishing, bathing, etc., has been forbidden, and in 1914, skating was also prohibited. Since 1913, an inspector of the watersheds has been employed.

Ice cutting is permitted, written permits being issued which contain a list of rules to be observed. There is one large ice company with houses on the shore of one of the lakes, the remainder of the cutting being mostly done by parties harvesting their own supply.

As the question of inconsistency in prohibiting fishing while allowing ice-cutting was brought up, the following extract from the report of the Water Board for 1913 may be of interest as showing the viewpoint of the Board:

"An opinion seems to prevail in the minds of some, that the issuance of permits to cut ice upon the lakes and streams of our water supply is inconsistent with the enforcement of rules and regulations relating to boating and fishing, and some special criticism has been directed against the Board upon this account.

"The essential facts bearing upon the question of ice-cutting seem to be as follows:

"Health authorities inform us that some forms of disease may be communicated through the medium of ice, as well as water, therefore it is generally agreed that impure ice is fully as detrimental to the public health as impure water.

"Ice, though not so extensively used, is absolutely necessary.

"Its purity must, therefore, be safeguarded. To this end our laws provide that the State Department of Health may establish ordinances to secure the inspection of ice sold within its limits and to prevent the sale of impure ice. They are further given, by statute, the general oversight and care of all inland waters and of all ponds and streams that are used not only by any water company but by any ice company; and they may provide for the granting of written permits for the purpose of harvesting ice, etc.

"Acting under the advice of the State Department of Health, this department has endeavored to provide proper supervision of ice cutting. Inspectors are stationed at the different ponds; and are present at all times during ice-cutting.

"The Board has found not only the two local companies, but the few individuals who harvest their own supply, willing and apparently anxious to comply with the rules and regulations imposed.

"The Board are prepared to still further restrict ice-cutting and even stop it altogether, whenever they feel that the health

of the water takers or the purity of the water supply demands such action. At the present time, however, with the supervision above referred to they believe that they are acting with due regard to the letter and the spirit of the law and are carrying out the policy of the State Department of Health.

"The board is of the positive opinion that reasonably pure ice can be supplied to our citizens, from our own lakes and streams if cut under careful supervision, and therefore deems it wiser to issue permits as heretofore, than to refuse such permits and force our public to procure ice from sources of which we have no knowledge and over which we can have no supervision."

The enforcement of the rules and regulations has received the endorsement of the local board of health and, I think, of a majority of our citizens. Of course all this provoked much opposition from the fishermen, and particularly from a local sportsman organization.

We knew that there was more or less fishing going on, but it is difficult to get the evidence that will convict.

During the last four years there have been six prosecutions for bathing; three for boating; seven for fishing, and one for not having a proper cesspool. Convictions were secured in the local court in every case but one.

A Mr. Hyde had openly boasted about the city that he fished when he pleased, and that the board could not stop him. We were aware of the fact that he fished, but had hitherto been unable to get direct evidence.

January 2, 1917, our inspector was on duty at one of the ponds where ice-cutting was going on, and, as we were having some trouble in keeping the pond clear of skaters, a special officer was on duty at the same place. I received a telephone message from a resident at Crystal Lake that several persons were fishing through the ice at Crystal Lake. We immediately sent our light truck to the pond, picked up our inspector and the policeman, and in half an hour they were at Crystal Lake, where they found Mr. Hyde with a full complement of lines through the ice, and a fine mess of fish on the surface of the lake. It was quite an interesting session for a few minutes, but he realized he was taken with the goods.

A complaint was sworn out, and in the local court a fine of ten dollars was imposed, and an appeal taken to the Superior Court.

Here it went before a jury on an agreed statement of facts.

The legal history of the case follows:

THE COMPLAINT.

COMMONWEALTH OF MASSACHUSETTS.

ESSEX, ss.

Frank S. Reed in behalf of the Commonwealth of Massachusetts, on oath, complains that Fred H. Hyde of Haverhill, in said county, on the second day of January, in the year of our Lord nineteen hundred and seventeen, at Haverhill, in said county, did then and there go upon the ice of Crystal Lake, so-called in said Haverhill, and did fish in said lake, without a written permit to do so of the Board of Water Commissioners of the said city of Haverhill, in violation of the Rules and Regulations of the State Board of Health of the said Commonwealth against the peace of said Commonwealth, and contrary to the form of the laws in such cases made and provided.

He, therefore, prays that said defendant may be arrested and brought before the said Central District Court of Northern Essex, in said county, and held to answer to this complaint, and further dealt with, relative to the same, according to law.

FRANK S. REED.

RECEIVED AND SWORN TO this third day of January, in the year of our Lord one thousand nine hundred seventeen.

Before said court.

A. FRANKLIN PRIEST, *Clerk.*

AGREED STATEMENT OF FACTS.

The defendant was complained of in the Central District Court of Northern Essex for going upon the ice of Crystal Lake, so called, in Haverhill, in said county, and fishing in said lake without the written permit to do so of the Water Commissioners of the said city of Haverhill, in violation of the rules and regulations of the State Board of Health of the Commonwealth. A copy of the State Board of Health Rules and Regulations in question is hereto annexed and made a part of this agreed statement, and it was a violation of Section 13 of said rules and regulations which was complained of.

On the 2d day of January, 1917, the defendant, who was a resident of Haverhill and engaged in the business of a real estate broker, went fishing upon Crystal Lake, which was at that time covered with ice, and while so fishing through holes cut in the ice was arrested. He had that day asked for a permit from said Water Commissioners to fish through the ice on said lake but was refused such permit. He was willing to conform to any reasonable requirement to obtain such permit. Permits had been given to cut ice on the same lake for sale to the public. The defendant was within the law relating

to the number of lines to be used in fishing, and was also observing the law in regard to the number of fish caught.

The water of said Crystal Lake is used as a source of water supply for the City of Haverhill, and is a great pond about five miles from the center of the city

LOUIS S. COX,
District Attorney.

Filed October 15, 1917.

HUBERT C. THOMPSON,
Attorney for Defendant.

REPORT OF CASE.

The above-entitled case was tried before me at the September sitting of the Criminal Court at Salem, upon an Agreed Statement of Facts filed herewith.

Upon the said Agreed Statement of Facts I instructed the jury that they would be warranted in returning a verdict of " Guilty," to which the defendant duly excepted.

The jury returned a verdict of " Guilty." The District Attorney moved for sentence. Whereupon I imposed a fine of $10.00.

Being of the opinion that the question raised by the above exception ought to be determined by the full Court, and at the request of the defendant, I report the case for the determination of the Supreme Judicial Court.

Upon motion of the defendant, execution of the sentence was stayed pending the determination of the question raised.

If the ruling was right the verdict is to stand, otherwise a new trial is to be granted the defendant.

Filed December 19, 1917.

HUGO A. DUBUQUE,
Justice of the Superior Court.

DEFENDANT'S BRIEF.

STATEMENT OF THE CASE.

The Rules and Regulations of the State Board of Health indicate that in the city of Haverhill at least four lakes and ponds are set apart for the water supply of the city. Of these lakes and ponds Crystal Lake is about five miles from the city proper. The Water Commissioners, acting under the authority of the State Board, refused a permit to the defendant, under any circumstances, to go upon the ice and fish; and by the same authority granted permits to others to go upon the lake and cut ice. There was no evidence of pollution of the water by the defendant, or that the defendant did not take every precaution to prevent any pollution of the water.

ARGUMENT.

Before the enactment of the Amendment of 1907, giving power to the State Board to delegate its authority to the local boards, it was decided by this court that the State Board could not delegate such authority, under Revised Laws, Chapter 75, Section 113, Commonwealth *v.* Staples, 191 Mass. 384. The above amendment following this case undoubtedly made valid such delegation, and a proper adhesion to the Rules and Regulations of the State Board by the local board has the same effect upon the general public as an act of the State Board itself.

In this case it must be remembered that the defendant is brought into court against his will. There is a marked difference between a party plaintiff who sues by civil means to obtain his rights and one who is complained of for committing a criminal act. (Stevens *v.* Casey, reported 29 October, 1917.) In the latter case the petitioner had not exhausted his remedies, while in the case at bar the defendant "can invoke protection from the court against the entire proceeding." The provision of 1907, giving a right of appeal to the State Board, was remedial in its nature, in favor of a defendant, and not a necessary step to be taken before he can offer a defense to a criminal complaint. (Stevens *v.* Casey, above.) Certainly the Commonwealth acquired no advantage by the defendant's failing to use an appeal from the constituted authorities of the Commonwealth. It follows that the acts of an agency such as the Water Commissioners, in following the Rules and Regulations of the State Board, have the same force as the acts of the State Board.

The combined action of both agencies of the Commonwealth had the practical effect of making a prohibition of the act of fishing through the ice. The facts in this case are similar in temper, at least, to those in Austin *v.* Murray, 33 Mass. 121, where a regulation amounting to a prohibition was declared void. The defendant contends that the act of fishing is capable of restrictions within its own class, and that a prohibition of the act under any conditions was never contemplated in the authority granted in Revised Laws, Chapter 75, Section 113, or its amendments, and was therefore arbitrary and unreasonable.

Again, it is admitted by the authorities that cutting ice was allowed by a permit under the same rules and regulations. In so doing the defendant was placed in an unjust and unreasonable classification. "While reasonable classification may be made in the interests of public health, public safety and public morals, yet there must be some rational relation between the object to be obtained and the classification in order that it may not violate the constitutional guaranty that all persons, including corporations, shall be equal in the protection afforded by the laws." (See Opinions of Justices, 220 Mass. 631.)

HUBERT C. THOMPSON,
For the Defendant.

COMMONWEALTH'S BRIEF.

STATEMENT OF THE CASE.

The defendant in this case was complained of, as stated in the Agreed Statement of Facts, for violating rules and regulations promulgated by the State Board of Health in accordance with Chapter 75 of the Revised Laws, Section 113, as amended by the Acts of 1907, Chapter 467, which reads as follows:

> "Be it enacted, etc., as follows:
> "*Section 113.* Said board may cause examinations of such waters to be made to ascertain their purity and fitness for domestic use or their liability to impair the interests of the public or of persons lawfully using them or to imperil the public health. It may make rules and regulations to prevent the pollution and to secure the sanitary protection of all such waters as are used as sources of water supply. Said board may delegate the granting and withholding of any permit required by such rules or regulations to state boards and commissions and to selectmen in towns and to boards of health, water boards and water commissions in cities and towns, to be exercised by such selectmen, board and commissioners, subject to such recommendation and direction as shall be given from time to time by the state board of health; and upon complaint of any person interested said board shall investigate the granting or withholding of any such permit and make such orders relative thereto as it may deem necessary for the protection of the public health.
> "*Section 2.* This act shall take effect upon its passage.
> "Approved May 29, 1907."

There was no question raised at the trial as to the form and promulgation in due course of the Rules and Regulations of the State Board of Health, which are made a part of the Agreed Statement of Facts, and there was no question but that the Board of Water Commissioners of the city of Haverhill was the board in control, on the date that the defendant was complained of, over the water supply of that community and of the water of Crystal Lake. Neither was there any contention at the trial, and it is conceded, that the defendant did not make any complaint to the State Board of Health after his request for a permit from said Water Commissioners had been refused. The defendant was merely a resident of the city of Haverhill, and claimed no rights of ownership about or around the waters of Crystal Lake.

ARGUMENT.

1. The contention of the defendant in this case, by inference from the Agreed Statement of Facts, must be that the Board of Water Commissioners of the city of Haverhill, in refusing him the written permit provided by the Rules and Regulations of the State Board of Health, acted unreasonably, arbitrarily, and invaded inherent statutory rights possessed by individuals to use great ponds for fishing. The answer to this, the Commonwealth submits, is that the defendant has not exhausted the rights given to him by

the legislature; and that he did not, when he felt himself aggrieved, file a complaint with the State Board of Health, as provided in the Acts of 1907, Chapter 467. In other words, he cannot now complain if the rules, under which he was convicted, are proper.

Stevens *v.* Casey (Department Reports, 655). 29 October, 1917.

2. But the Commonwealth further contends that, on the assumption that the action of the board is arbitrary, an individual citizen has no appeal to the courts in a matter of this kind where the legislature has entrusted quasi-legislative functions to the State Board of Health and local boards under its jurisdiction.

The Court said, in Nelson *v.* State Board of Health, 186 Mass. 330 at 335, speaking of rules adopted by the State Board of Health (under Statute 1897, Chapter 510, Section 1, which act was incorporated in the Revised Laws, Chapter 75, Section 113, in issue here), "We are of the opinion that rules adopted by the State Board of Health under Statute 1897, Chapter 510, Section 1, are quasi-legislative."

This Court has already said, referring to a state administrative board, in Com. *v.* Sisson, 189 Mass. 247 at 252, which was a stronger case for the defendants, in that they were private owners of land adjoining the pond, where it was sought to protect fishing, that "no more than in the case of the legislature itself is it bound to act only after a hearing or to give a hearing to the plaintiff when he asks for one; and its action is final, as is the action of the legislature in enacting a statute. And being legislative, it is plain that the questions of fact passed upon by the commissioners in adopting the provisions enacted by them cannot be tried over by the court."

The Commonwealth submits that the reasoning underlying the above quotation applies, with equal force, to the action of a local board in refusing to issue a written permit to fish in the waters of a great pond reserved for water supply, without giving reason therefor. "The remedy is by application to the legislature, if a remedy should be given." See Com. *v.* Sisson, 189 Mass. at 254.

LOUIS S. COX,
District Attorney, Eastern District.

THE DECISION.

ESSEX. FEBRUARY 9, 1918.

COM. *v.* HYDE.

WATER SUPPLY — PROHIBITION OF FISHING BY MUNICIPALITIES WITHIN POLICE POWER IN ORDER TO MAINTAIN PURITY OF WATER.

RUGG, C. J. — This is a complaint charging the defendant with going upon the ice of Crystal Lake and fishing therein without a written permit of the water commissioners of the city of Haverhill, in violation of Rules

and Regulations of the State Board of Health. The pertinent part of the regulation of the State Board of Health is as follows:

> "No person shall . . . unless permitted by a written permit of the board of water commissioners of the city of Haverhill fish in . . . Crystal Lake . . . so called in the city of Haverhill . . . said lakes . . . being used by said city as sources of water supply."

The regulation was passed pursuant to Revised Laws, Chapter 75, Section 13, as amended by Statute 1907, Chapter 467, Section 1, which empowers the State Board of Health to "make rules and regulations to prevent the pollution and to secure the sanitary protection of all such waters as are used as sources of water supply," with power to delegate the granting or withholding of permits to water commissioners, subject to investigation and revision by way of appeal to the board itself.

The delegation by the legislature of the right to make rules and regulations is within its power. (Com. *v.* Sisson, 189 Mass. 247. Com. *v.* Kingsbury, 199 Mass. 542.) The case at bar thus is distinguished from Com. *v.* Staples, 191 Mass. 384, where no power of delegation was conferred by the statute there under consideration. The power of revising the conduct of the water commissioners reserved to the State Board of Health by the statute avoids the difficulty of vesting an untrammeled discretion in a subordinate board or officer, which was held fatal to the ordinance before the Court in Com. *v.* Maletsky, 203 Mass. 241; Goldstein *v.* Connor, 212 Mass. 57; Stevens *v.* Landowner, 228 Mass. 368. The regulation passed by the State Board of Health in pursuance of the statutory authority, prohibiting fishing upon a body of water used as a source of water supply for a municipality, cannot be pronounced unreasonable. It requires no discussion to demonstrate that the preservation of the purity of the water supply for the domestic uses of the people is within the police power. The absolute prohibition of fishing upon such a source of supply could not be said to be unreasonable under circumstances here disclosed. It is not irrational for a public board to deem it likely or possible that sources of contamination and germs of disease might have a casual connection with the presence of fishermen upon the ice or waters of a supply of drinking water. (Nelson *v.* State Board of Health, 186 Mass. 330. Sprague *v.* Minor, 195 Mass. 581.) The case of Austin *v.* Murray, 16 Pick. 121, upon which the defendant relies, is quite distinguishable.

LOUIS S. COX,
Attorney for Commonwealth.

HUBERT C. THOMPSON,
For Defendant.

The decision of Justice Rugg was given February 9. Our local paper of the 14th contained the following information:

"In the Superior Criminal Court before Judge Dubuque at Salem, Fred H. Hyde, who had been found guilty of a violation of the regulations of the

State Department of Health, was fined $10.00. George Picard and George Walsh, whose appeals were pending on similiar charges, plead guilty and were each fined $5.00."

The State Department of Health have now sent the following letter to every water board in the state:

"It having come to the notice of the State Department of Health that permits are being granted for fishing in some of the bodies of water used as sources of public water supply, and that much pressure is being brought to bear in many places for the granting of such permits on account of the alleged desirability of taking the fish for the purpose of increasing the food supply, the Department takes occasion again to call attention to the great danger to the public health that is likely to result from this practice. The investigations of the Department have shown that, where fishing is permitted, pollution of the water inevitably results, and the danger that polluting matters deposited by fishermen or others upon or in the neighborhood of reservoirs used as sources of water supply may enter the pipes and cause injury to health is, in its opinion, most serious.

"The Department recommends that no permits be given for fishing in any body of water used as a source of public water supply from which water is taken directly for drinking, and that no fishing be permitted in tributary sources, unless advised by this Department, and then only under such limitations and restrictions as the Department shall recommend.

"Your attention is called to a recent decision of the Supreme Court in a case at Haverhill relative to the prohibition of fishing by municipalities in order to maintain the purity of water used for drinking. A compared copy of this decision is appended hereto.

"By order of the State Department of Health,

"A. J. McLAUGHLIN,
"*Commissioner of Health.*"

Discussion.

The President. The paper is now open for discussion or the asking of questions. The program this afternoon seems to me to illustrate the great variety of subjects with which water-works men have to be familiar. We have had geology by Mr. Fitzgerald, electricity and water power by Mr. Coggeshall and Mr. Mendell, and now we come down to legal questions and public-health questions, all of them very vital and everyday matters.

Mr. Percy R. Sanders.* We have had a case in Concord, N. H., on our water supply. Our Board got up rules and regula-

* Superintendent Water Works, Concord, N. H.

tions similar to those Mr. Sawyer, of Haverhill, has read to you, and the public took exception to some of the rules. We didn't go so far as to prohibit boating and fishing all over our lake, but we prohibited it one-quarter of a mile from our intake.

Our water supply is taken from two connecting ponds, Long Pond, or Penacook Lake, and Forge Pond. Penacook Lake is two miles long and one-half mile wide at its widest point, with an area of 338 acres; Forge Pond is a small body of water at the outlet. When the works were built, in 1872, the city built a dam about one-half mile down stream from the old outlet, raising the height of water about six feet and flooding an additional area between the old outlet and the new dam, increasing Forge Pond to 30 acres.

When our rules and regulations for the sanitary protection of our supply were adopted in 1915, all boating and fishing were prohibited on Forge Pond in addition to the quarter of a mile from the intake in the lake. As this was the most accessible approach to Penacook Lake and most of the landings and moorings were there, the effect of the regulation was to stop the boating from this end and thus nearly all boating anywhere on the lake.

One owner took exception to the regulation. He owned a steamboat and he refused to take his boat from the closed part of the lake. We gave him a certain time in which to do it and when he didn't comply with our order we took his boat to the upper end of the lake and notified him that he could take care of it. He didn't do so, — I suppose he left it with the idea that he could collect damages from us. He then brought suit against us to have his privileges restored to him. The case came to trial in the Superior Court, and the judge upheld us in all our rules and regulations, deciding that they were fair and reasonable, and that this man had no right to run his boat on the prohibited part of the lake. He owned no land where his wharf was built. The judge ruled for us on every question that we asked him to rule on, — that these rules were made for the protection and care of the supply. The man and his friends were so disheartened at the decision that they didn't carry the matter to the Supreme Court. Of course we would have felt better satisfied if it had gone to the Supreme Court, but I think that they felt, by the judge granting

every one of our requests, that there would be absolutely no chance for them.

We had another case, two or three years before this, with this same man, and he lost out at that time. I think the fact that he lost in both cases rather took his courage away, so he thought that he had spent about money enough, and wouldn't carry the matter any further. It seems to me that this shows that the Courts are willing to grant us about anything we ask for that is reasonable for the protection of our supplies. The first time we were before the court the judge made the remark that if any child or any person should become ill by reason of the boating, he would always feel that he had neglected his duty. And I think that is the opinion that Courts all have.

MR. WILLIAM F. SULLIVAN.* I wish our lamented friend Walker was here, but his successor is here, and perhaps he can tell us how Mr. Walker, in the absence of law and regulations, became judge and jury and court and everything else, and when he couldn't regulate the use of Massabesic Lake in any other way he went over there and destroyed camps and was denounced and almost hanged for it.

MR. MENDELL. Mr. Walker sometimes took things into his own hands, and he burned up several camps that had been more or less complained about. He also did another thing, which I think may interest you. The Manchester Coal and Ice Company cut their ice on Massabesic Lake, and he made them furnish to every fifty men an iron receptacle which they would take on to the ice in the morning and take off and empty over five hundred feet from the shore every night. If it was frozen up, they had to thaw it out and clean it. Fishermen bother us more than the ice cutters, because they are here and there all over the lake, and it keeps men all winter looking after them.

MR. SULLIVAN. Did the owners prosecute Mr. Walker?

MR. MENDELL. Yes, they did. We didn't want it to get to court, so the Commissioners and Mr. Walker chipped in and we paid for it out of our own pockets.

MR. SAWYER. Personally, I am not in favor of allowing ice cutting, but the position our water board has taken in regard to

* Engineer and Superintendent Pennichuck Water Works, Nashua, N. H.

that is that the ice cutting is done in a restricted area and can be watched. If you allow fishing and skating on the ice it is impossible to have inspectors enough to follow it up, but one or two inspectors can look after the ice cutting. We have seen a good many articles in the paper, this winter and in other years, about different lakes which are open for fishing and one thing and another, and I have taken pains to follow up every case I have seen in the papers, and in almost every instance I find that the facts have been misrepresented. Incidentally I might say that the game and fish commissioners in Massachusetts apparently do not work in conjunction with the State Department of Health. A representative of the Fish Commission, speaking some time ago in Haverhill, claimed that it was a good thing to allow fishing, and he instanced the city of Springfield, where indiscriminate fishing was allowed. I wrote to Mr. Martin, and he said that the man was partially right, that they did issue permits for fishing in the part of their system which supplied Ludlow, ten miles from the city of Springfield, but they had discontinued that part as a source of supply for Springfield. Then there was another article which said that they were allowing fishing in Natick. The superintendent informed me that they were allowing fishing there, but it was on the Metropolitan system, and that Natick didn't take the water from the pond but took it from wells. A few weeks ago it was said that they were issuing permits for fishing in the Avon reservoir in Brockton, but I am told that that reservoir is not used for a water supply at all, but simply as a storage reservoir. I also had my attention called to the conditions in Manchester, where fishing was allowed, and I wrote to Mr. Mendell, who said that they didn't believe in it up there, but I received the impression that they hadn't quite got the courage of their convictions to stop it.

MR. MENDELL. They have the spirit but not the power.

MR. CHARLES R. WOOD.* This talk on fishing is interesting, because the United States Government has exempted from the draft a certain number of agriculturalists, and a good many people in South Jersey at the present time are very much worried to know whether a clam digger is a fisherman or a farmer.

* Of R. P. Wood & Son, Pipe Manufacturers, Philadelphia, Pa.

[*Laughter.*] I wish somebody might give me some information on that point.

MR. SIDNEY SMITH.* I will give you an answer from New Jersey. A clam digger is neither a fisherman nor a farmer; he is a miner. [*Laughter.*]

MR. PATRICK GEAR.† I want to give a benediction from Holyoke. A couple of years ago I rode out to the pond one day and I found some men there fishing through the ice. I asked them if they caught any short fish what they did with them? They didn't know. I said, "You know the rule is that we don't allow you to throw them back into the water, for they will die after they have been hooked." Well, I was talking with these fellows about it, and they showed me a place over in a corner on the shore where they were frying a few short ones, and they asked me over to lunch. I went over with them, and just then three great, healthy chaps came along and jumped over the fence from different sides of the road and came up to us and showed their badges, and they were fish and game wardens. So they looked around to see how many fish there were, and they were within the number allowed by law. Then they looked the fish over to see if there were any short fish. I asked if they caught any short fish what they should do with them, and they said, "Throw them back into the pond." But I said, "No; I won't let them. If they throw them back into the pond I will arrest them." So I said to the wardens, "What are you going to do about it?" And one of them said, "I don't know. I can't arrest them when they are on this pond," for while it is a great pond the city of Holyoke was given control of it seven or eight years ago by the state. He said he couldn't arrest them if they had short fish, while they were on the pond, because we controlled it but if they got on the road he could arrest them. We never settled what would become of the fishermen who caught short fish; he wouldn't let them keep them out and I wouldn't let them put them in. [*Laughter.*] Later the warden sent us a letter and advised stopping fishing altogether through the ice. We did stop it except three days a week, but we have never settled yet what to do with the short

* Civil Engineer, Boston, Mass.

† Superintendent Water Works, Holyoke, Mass.

fish. If we stop fishing entirely we will put one of their nice jobs out of business, and that is the fish hatchery, because they put trout in the brooks and they won't let us fish in the brooks, and if we won't let them fish in the pond the hatchery will have to go out of business.

MR. SAWYER. We have a mayor in Haverhill, at the present time, who is much in favor of fishing, and I am sorry to say that the matter is getting to be somewhat of an issue in the election of water commissioners. It has been reported that the member whose term expires next May can be reëlected by the Municipal Council provided he will vote to open one of the ponds for fishing, but if he does not he is doomed for decapitation.

THE PAST AND PRESENT PUMPING EQUIPMENT OF THE MANCHESTER PUMPING STATIONS.

BY JAMES H. MENDELL.*

[*Read March 13, 1918.*]

Mr. President, Guests, and Members of the New England Water Works Association, — The paper I shall read is a history of the past and present pumping equipment of the city of Manchester, N. H., but first I want to call your attention to my predecessor, the late Charles K. Walker, who was known to many of you. Mr. Walker began his services with the Manchester Water Works in 1873, was elected superintendent in 1875, and retired on April 1, 1912, giving to the city a continuous service of nearly forty years and leaving a record which few if any of us will ever equal, for it is said of him that the city of Manchester was never without its water supply for a single hour during his long term of service, and to his efforts are due many of the improvements which have been made in our pumping equipment.

Who first conceived the idea of a public water supply for the city of Manchester I do not know, as the first records we have are in the year 1868, when the city councils voted to have surveys, plans, and estimates of costs made of several different sources of supply. This took about three years, and Lake Massabesic, our present source of supply, was decided upon. The wisdom of this choice is apparent to-day to every thinking citizen of Manchester, for it is estimated that this supply is ample for a city of 250 000 inhabitants, and in quality is unsurpassed by any city in New England.

This lake lies about four miles east from City Hall, has a surface area of 2 500 acres with a varying depth from a few feet to over two hundred, a watershed of 40 square miles, and a shore line of over 25 miles, 85 per cent. of which is owned and controlled by the water department.

The water supply at the present time is pumped from two stations, known as the low- and high-service. The water from the

* Superintendent Water Works, Manchester, N. H.

low service is pumped into a reservoir, from which the water flows, by gravity, through the distribution system, giving a pressure at City Hall of about 60 lb. This station was built in the years 1871–72 near the outlet of the lake, located at an elevation sufficiently low to enable water-power to be used for pumping. The water was delivered through an open canal and 600 ft. of 72-in. wooden stave penstock, with a head of 45 ft. This penstock was in use for forty-one years, being replaced in 1913 with one of steel.

This station was equipped with one Wood vertical, quadruplex, single-acting pump, having a rated capacity of 5 000 000 gal. in twenty-four hours, connected to 2 vertical 36-in. water-wheels, which furnished the power to operate this pump, using $7\frac{1}{2}$ gal. of water to each gallon of water delivered into the reservoir. For the first three years it was only necessary to run this pump from three to five hours every other day. From that time until 1886, it was run every day, first about three hours and gradually increasing to eight.

In 1886, it became necessary to make extensive repairs to the water-wheels and pump, and two vertical 36-in. Risdon water-wheels were installed to replace the old ones, also a Davidson horizontal, duplex, double-acting pump, having a daily capacity of 5 000 000 gal. The power for operating this pump was communicated from the old jack shaft in such a manner that the pumps could be operated separately or together. As the Davidson pump would deliver one fourth more water into the reservoir with the same amount of water used, the old Wood pump was only used in case of emergency.

This equipment furnished the supply until 1893, but for several years before this the water commissioners had decided that the rapid growth of the city would make necessary the installation of another system where higher pressure could be maintained. Plans were made in 1890, and work began in 1891, upon what is now called our high-service system. The station and reservoir were finished in 1892, but the water from this system was not used until early in 1893.

This station was located about two miles from the low-service station, near the lake shore, the water supply taken from a point

250 ft. from the shore of the lake through a 24-in. cast-iron pipe into a well underneath the station. The station was equipped with two Worthington steam pumps, having a daily capacity of 3 000 000 gal. each, a suction lift from 9 to 15 ft., pumping against a head of 290 ft. The steam to operate these pumps was furnished by two 150 h.p. Manning-type unright boilers. The water was pumped directly into the system with an equalizing reservoir for use when the pumps were not running. The distribution system was divided, and only the highest elevations were supplied from this station. The running time, until 1895, was from five to ten hours every other day, when more of the distribution system was taken from the low service and added to the high service, making it necessary to pump every day from eight to twelve hours. In 1900, an addition was built to this station for the purpose of installing a Snow pumping engine with a daily capacity of 6 000 000 gal. The steam for this pump was furnished from the 150 h.p. boilers, which were used for this purpose until 1910, when they were exchanged for two 250 h.p. boilers of the same type. During this time the old Worthington pumps were only run two days each month, or, in other words, only enough to keep them in condition for use in case of emergency.

In the fall of the same year, a one-story addition was built to the low-service station, in which was installed a 6 000 000-gal. single-stage DeLaval centrifugal pump with a direct connection to a 200 h.p. motor. The power for this motor was furnished by the Manchester Traction, Light and Power Company at a cost of $2\frac{1}{2}$ cents per kw.-hr. This increased the cost of pumping from $3.00 per million gallons, by the old water pumps, to $18.20 per million gallons by the centrifugal pump, and for the reason of this high cost the electrically driven pump was only used in periods of extremely low water.

In 1913, the consumption of water was so much greater that the water pump had to be run fourteen hours per day to supply the demand. For this reason it was deemed best to make some changes at this station, and after several plans had been made it was decided to use the water-power for the development of electricity. This necessitated the removal of the old water-power pumps, which were sold as junk, and in 1914 a pair of 250 h.p. Trump

turbine water-wheels, directly connected to one 375 kw. generator, were installed. During the period of this installation, the centrifugal pump was run by power furnished by the Manchester Traction, Light and Power Company. With this equipment completed we had sufficient power to operate the 6 000 000-gal. centrifugal pump at the low-service station and a 3 000 000-gal. centrifugal pump at the high-service station, a transmission line having been run between the two stations; and all of the water pumped into both the high- and low-service reservoirs, for ten months in the year 1914, was by power furnished by the new electric development at the low-service station.

This equipment proved so satisfactory that the following year it was decided to develop electricity by steam at the high-service station, so that all pumping could be done with electrical power. For this purpose two electrically driven centrifugal pumps were purchased, a 5 000 000-gal. for the high service, and an 8 000 000-gal. for the low service, together with a 1 000-kw. steam turbine generator, and the necessary auxiliary apparatus. To make room for the new machinery at the high-service station, the old Worthington pumps were removed and the room from which they were taken remodeled to fit the new equipment, the installation of which was completed in October, 1917, and has been in operation since.

We are very fortunate in our sources of power supply, being connected with the power plant of the Amoskeag Manufacturing Company, the Manchester Traction, Light and Power Company, in addition to our own water and steam supply. With these four different sources of power with which to operate, we believe we have to-day the very last word in electrical apparatus for the operation of electrically driven pumps.

Fourteen million gallons can be pumped at the low-service station, and 8 000 000 gal. at the high-service in twenty-four hours, with the electric pumps, with the 6 000 000-gal. Snow pumping engine in reserve at the high-service station, making a total pumping capacity of 28 000 000 gal. per day. With this equipment, situated as it is in two different stations, it is hard to conceive of conditions such that the city of Manchester could not be supplied with water.

A LOG BOOK FOR AN ELECTRICALLY DRIVEN PUMPING UNIT AT NEW BEDFORD.

BY R. C. P. COGGESHALL.

[*Read March 13, 1918.*]

The Little Quittacas Pumping Station, which is furnishing the entire supply to the city of New Bedford, is equipped with two compound beam and fly-wheel engines of the well-known "Leavitt" type. They are in duplicate, and each has a capacity of pumping 10 million gallons in twenty-four hours. They have been in commission since 1899. The population supplied at that time was 58 000, and the average daily consumption was 6 300 000 gal. Last year the population reached 115 000, and the average daily consumption was 9 200 000 gal. Since the installation of the engines at the Quittacas Station, they have been operated alternately, but never together, until July of last year. There have been occasions in the past when the aggregate of several days' consumption was in excess of pumping capacity of one engine, but, hitherto, of such short duration that the compensation provided by the distributing reservoir has enabled one engine to provide the necessary amount by pumping continuously for several successive days.

The consumption of 1917 required the reinforcement of the second engine occasionally during "peak loads" periods. These occasions, however, were of short duration, and only a portion of the full capacity of the second engine was required.

As the result of considerable study it was finally decided to install one five-million gallon DeLaval, electrically driven, centrifugal unit. This may be used alone, or in connection with one or both steam pumps.

When used alone, it will pump 5 million gallons in twenty-four hours; in connection with one steam pump, 15 million gallons in twenty-four hours; and in connection with both steam pumps, 25 million gallons in twenty-four hours.

* Superintendent Water Works, New Bedford, Mass.

The current necessary to operate this unit is to be supplied from the plant of the New Bedford Gas and Edison Light Company, who will furnish same at the Quittacas Station upon the kilowatt-hour base. As this unit does not require the operation of a boiler at the Quittacas Station, this unit may be put in service during holidays or Sundays, when it is desirable to shut down the steam plant.

Many of the electrically driven centrifugal pumps installed in late years are operated by power purchased of some public utility plant upon kilowatt-hour base. Such is New Bedford's case.

The various steam pumping plants with which the speaker is familiar have a complete record of their pumping operations from their very beginnings. The items entered therein and the stated duties are given in accordance with the recommendations and formulæ prescribed by the New England Water Works Association. These duty formulæ (Fig. 1,) give the number of million foot-pounds elevated per one hundred pounds of coal consumed.

In case of steam plants, the exact weight and cost of coal delivered at pumping station boiler is easily determined. This is, however, not true of an electrically driven pump operated by current purchased upon kilowatt-hour base. The best expression in million foot-pound duty to cover this last-named condition is obtained by substituting " kilowatt-hours " in place of " total fuel consumed " in the well-known N. E. W. W. A. formulæ.

The duties obtained by using coal in one instance and kilowatt-hour in the other produce results that greatly differ and that cannot be compared, but all results based on the kilowatt-hour can be compared. The same is true where the coal consumed is the base.

I have been unable to locate a log book for electricity operated centrifugal pumps which supplements the ideas conveyed by the records of the steam units of same station, so I have undertaken the design of such a book, and herewith present reproduction of a page. It explains itself. The required data is easily obtained in our case.

A Venturi meter upon the delivery pipe, just outside the pump house, records the gallons pumped. This may be checked by use of measuring weir in distributing reservoir gate house, eight

[Left-hand page.]

FIVE

DATE.		TIME OF STARTING. Hr.	Min.	STOPPING. Hr.	Min.	WORKING. Hr.	Min.	DELIVERY. Venturi Meter. 6 a.m.	Number of Gallons Pumped. 24 hours.	Ammeter.
	1 to 31									
MONTHLY TOTALS										
MONTHLY AVERAGES										

Monthly Duty—Number Gallons Pu

Total kilowatt

[Right-hand page.]

FIVE

DATE.		WATT METER. Meter Readings. 6 a.m.	Current Used Kilowatt Hrs. 24 hours.	SUPPLIES. Oil.	Grease	Waste	
	1 to 31						
MONTHLY TOTALS							
MONTHLY AV.							

NEW BEDFORD WATER WORKS.

FIVE MILLION GALLON DELAVAL ELECTRICALLY DRIVEN CENTRIFUGAL PUMP.

Record of observations for the month of

GAGES.				TEMPERATURES.			WATER LEVELS IN FEET.									
...meter.	Suction.	Delivery.	Mercury Column.	Pump Well.	Engine Room.	Baromter.	PUMP WELL.				DISTRIBUTING RESERVOIR.				Static Head.	Dynamic Head.
	Feet.	Feet.	Inches.				6 a.m.	12 noon.	6 p.m.	12 mid.	6 a.m.	12 noon.	6 p.m.	12 mid.		

... Gallons Pumped ( ) x 8.34 x 100 x Dynamic Head ( ) = million pounds raised one foot high
...ial kilowatt hours ( ) per 100 kilowatt hours

QUITTACAS PUMPING STATION.

FIVE] MILLION GALLON DELAVAL ELECTRICALLY DRIVEN CENTRIFUGAL PUMP.

Record of observations for the month of

...PLIES.		DUTY.				
...Grease	Waste	Number of Revolutions per Minute.	In Pounds Raised 1 Ft. High per 100 Kilowatt Hours.	No. Gallons Pumped per Kilowatt Hr.	No. Gallons Raised 100 Ft. per Kilowatt Hour.	REMARKS.

miles distant. The dynamic head is recorded from the readings of pressure gages and mercury column. The watt meter records the kilowatt-hours. In making up duty formulæ, substitute "kilowatt-hours" in place of total fuel consumed.

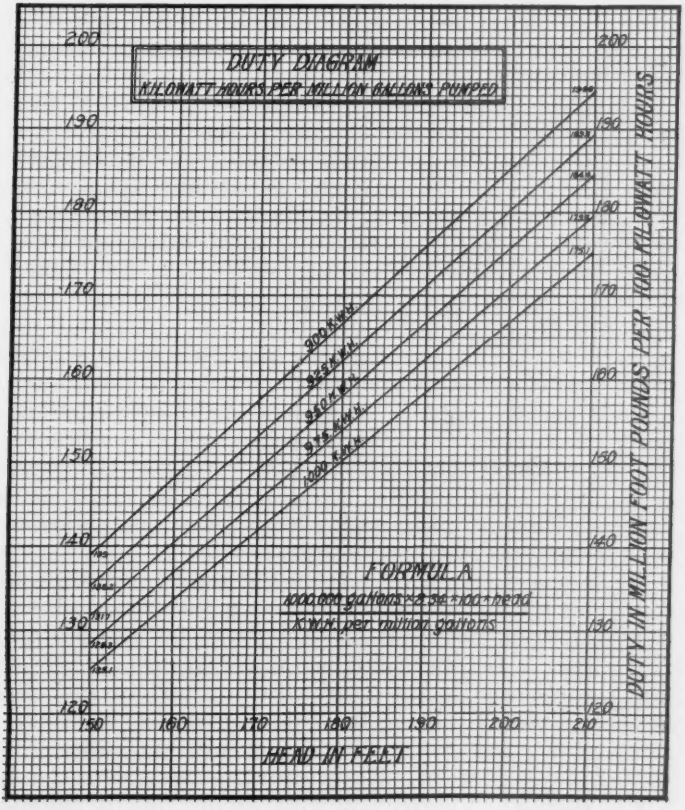

FIG 1. DUTY DIAGRAM.

I am also showing a diagram by means of which the approximate duty may be quickly determined for short runs without resort to many figures.

Discussion.

The President. I suggest that Mr. Mendell's paper and Mr. Coggeshall's paper be discussed together. This is what we hope to be but the beginning of a more or less continuous program of papers and discussion on pumping-station power, beginning with Mr. Doane's paper last month, and, perhaps, culminating at the annual convention.

A Member. I should like to ask the gentlemen what they have to pay per kilowatt-hour.

Mr. Mendell. We are paying to-day $2\frac{1}{4}$ cents per kilowatt-hour. The price has been reduced a quarter of a cent since we have made our own development. We think we can develop it by water for a little less than three-quarters of one per cent. The cost of the development by steam I am unable to give you, because the time has been so short and the conditions have not been practicable for making a test.

Mr. Edwin C. Brooks. Has Lake Massabesic storage enough to run wheels for constant pumping?

Mr. Mendell. In 1914, we pumped all the water by water-power. In an ordinary year we pump from eight to nine months, but you remember that 1914 was quite a wet year. We have another water-power which we hope to develop this year or next, and that will give us something like 300 kw. more, which will give us all the power we shall need for several years.

Mr. Coggeshall. In reply to the gentlemen's question as to cost, I will say that we know it is going to cost us a good deal more than steam, but the more electricity we take the less the rate is going to be. Our object now is to take care of the peak load, the overload, and the electrically-driven unit will probably be used but very little during the next few years, because we have ample power, most of the time running with one engine. It will only be used when we want to help out.

Mr. Mendell. I infer from what you say that the Electric Company will make a sliding price scale.

Mr. Coggeshall. Yes, they will.

A Member. I understand you will not use steam at all in Manchester, except in an emergency?

MR. MENDELL. No, not at all.

A MEMBER. You wouldn't do away with steam altogether?

MR. MENDELL. We would if we didn't have this Snow pumping engine, which is comparatively new.

MR. GEORGE F. MERRILL. I should like to inquire if it can be ascertained what the efficiency of the Manchester plant is, as the power is generated by steam and then passed through the centrifugal pumps.

MR. MENDELL. The loss is very small, being connected as we are with our pump right in the same room with our wheel development. Our wheels develop about 85 per cent. of their rated capacity, and there is something less than 2 per cent. lost in going through the switchboard and the motor. On the transmission line we lose about 10 per cent., crossing from one station to the other.

MR. JOHN C. CHASE. I was much interested in Mr. Mendell's paper as showing the changes which have taken place in about half a century. While there are several points in connection with the beginning of the Manchester water works that I might like to elaborate, it is hardly the time to do it in connection with a paper devoted entirely to the power plant. I happen to be, with possibly one exception, the only survivor of the engineering force of that early period. My connection with the water supply of Manchester began in the fall of 1869, in making the survey for the old Manchester Aqueduct Company, which had proposed to supply the city with water provided the city would guarantee the interest on the cost at the rate of six per cent. The city was very willing to guarantee the interest on the bonds, provided the Aqueduct Company would give them all over the six per cent. that they might earn later on, but the project fell through. The surveys were utilized afterwards in the construction of the water works and the development of the water power at Lake Massabesic, and were also used later on by the city when they decided to build the works in 1871.

I entered the service again in 1871, and remained until Mr. Walker's election in 1875. Several schemes were presented, — I think nine in all. Colonel Fanning, whom you all know, was chief engineer, and any project which had any merit was con-

sidered. But they gradually narrowed down to two: Pumping by water power from Lake Massabesic, or the conducting of the water by gravity from the head waters of the lake, which, if my recollection serves me, would utilize about one third of the watershed. It has been a question in my mind, looking back, whether we discounted the future enough at that time. Lake Massabesic was then practically an unknown territory. Although it was only four miles from the city it was over a ridge, and the only means of reaching it was by a steam railroad which operated two trains a day. There was a small public house out there, and I suppose if one hundred people went out there in a day in the summer time, it would be something unusual, and, if any thought at all was given to it, it was considered most unlikely that the water would ever become contaminated. But shortly after the works were built the attention of people began to be attracted to the place as a resort, and the result was that numerous houses were built about the lake, and a large summer population came there, which did not conduce to the attractiveness of the lake as a source of water supply, and eventually led to the city taking the matter in hand and buying up the land, so that now, as Mr. Mendell has said, the city owns about 85 per cent. of the lake shore. That has destroyed to a very large extent the taxable value of the property, and in my mind there has been a question whether we didn't make a very serious mistake in the beginning in not taking the supply from the head waters, where it would be delivered by gravity all over the city, instead of putting in a pumping plant which has been enlarged, as Mr. Mendell has told you, several times. I am not prepared to present any exact figures in relation to the matter, but I think that the lost taxes on the property which has been destroyed would have fully offset the larger interest charges of the gravity scheme and left a large asset in the way of a summer resort for the city. The water damages would undoubtedly have been much less, and a very large investment in the pumping plant would have been saved. Of course as it is to-day no one would think of destroying all this property and going back to the original proposition, but it is merely an illustration of how little we know what is going to take place forty or fifty years in the future. I trust that Mr. Mendell will

not think I am criticizing him or his associates in any way, but this is the sober second thought after a matter of nearly fifty years.

MR. MENDELL. I might say about two thirds or seven eighths of the property did pay taxes. The back land they are now contemplating using for a park.

MR. CHASE. That will, of course, bring in some salvage.

MR. FRANK L. FULLER. I should like to ask Mr. Mendell whether he doesn't think it would have been of advantage to the city if a filtration plant had been installed and the lake shore allowed to be built up with these small cottages.

MR. MENDELL. That has been considered, and its advantages and disadvantages argued. I think perhaps it might have been if the work had been begun earlier, but the first thought of the water commissioners was to own the land and control it, and they have always acted upon those lines. How much of a development there might have been for a summer colony, if we had had a filter plant, I don't know.

A MEMBER. We would be interested to know what you have done along the lines of your forestry operations.

MR. MENDELL. I presume that most all water works which have a lot of land are doing more or less forestry work. We began forestry work in 1913, and up to the present time we have put out something over 500 000 pine seedlings. This land we have bought is not going to be a total loss to the city, because we have sold, this winter, standing timber which will amount to nearly $20,000, besides probably from 1 400 to 1 500 cords of wood which we have sold on the land at $6 a cord. I presume the city of Manchester could sell to-day $250 000 worth of pine timber on the land that the department owns. This that we have sold is some which is ripe and ready to cut, and we are selling it off in this way.

RICHARD W. BAGNELL.

CHARTER, ACTIVE, AND HONORARY MEMBER OF THE NEW ENGLAND WATER WORKS ASSOCIATION.

Born December 2, 1822. Died April 1, 1918.

Richard W. Bagnell[3] was born at Plymouth, Mass., on the date named above. He was the son of Richard and Lydia (Sampson) Bagnell, both of Pilgrim and Revolutionary ancestry. His grandfather Richard Bagnell[1], as a soldier, responded to the Lexington alarm in the early days of the Revolution and was a captain in the Continental Army. For three generations, Richard[1], Richard[2], and Richard[3], the Bagnells were expert shipbuilders.

Mr. Bagnell followed his chosen trade until he was over fifty years of age. He was a recognized expert in the technical part of designing the famous clipper ships that placed the American merchant marine in such a commanding position just previous to the Civil War. At this period, Mr. Bagnell worked at East Boston under Donald McKay and other famous designers of the time. During the Civil War, Admiral Farragut was so much impressed with the ability shown by Mr. Bagnell that he endeavored to have him transferred to the famous frigate *Hartford*.

Previous to the Civil War, Mr. Bagnell took deep interest in the state militia and was a member and officer of Plymouth's historic military company, the Standish Guards.

As the maritime industries of Plymouth declined, Mr. Bagnell sought other occupations, and on May, 1874, was elected superintendent of the Plymouth Water Works, a position which he continued to fill until 1901, when Arthur E. Blackmer was elected active superintendent and Mr. Bagnell was retained as superintendent emeritus upon a pension, as a deep appreciation of the good work which he had accomplished. He continued to visit

the office daily until a few weeks before his death, and his interest in the details of the work in progress continued to the last.

Mr. Bagnell was married in November, 1848, to Harriet Allen, by whom he had five children; three of them were living at the time of his death.

Mr. Bagnell was one of the three survivors of the twenty-five representatives who met on June 21, 1882, at Young's Hotel, Boston, and organized this Association. He immediately took a deep interest in its affairs, and did what he could to promote its usefulness.

PROCEEDINGS.

March Meeting.

Hotel Brunswick,
Boston, Mass., March 13, 1918.

Carleton E. Davis, President, presiding.
The following members and guests were present:

Honorary Members.

E. C. Brooks.
Frank E. Hall.
R. C. P. Coggeshall.
R. J. Thomas. — 5.
Desmond FitzGerald.

Members.

T. C. Atwood.
J. F. Barrett.
C. H. Bartlett.
A. E. Blackmer.
J. W. Blackmer.
George Bowers.
J. C. Chase.
F. L. Cole.
C. E. Davis.
John Doyle.
J. H. Dillon.
E. D. Eldredge.
Frank Emerson.
F. F. Forbes.
F. L. Fuller.
Patrick Gear.
H. T. Gidley.
F. J. Gifford.
T. C. Gleason.
H. J. Goodale.
A. R. Hathaway.
D. A. Heffernan.
J. L. Howard.
A. C. Howes.
W. F. Howland.
G. A. Johnson.
Willard Kent.
S. E. Killam.
G. A. King.
P. J. Lucey.
F. A. McInnes.
Thomas McKenzie.
H. V. Macksey.
A. E. Martin.
John Mayo.
J. H. Mendell.
F. E. Merrill.
G. F. Merrill.
F. L. Northrop.
W. H. O'Brien.
H. E. Perry.
J. L. Rice.
L. C. Robinson.
P. R. Sanders.
A. L. Sawyer.
Sidney Smith.
G. A. Stowers.
J. F. Sullivan.
W. F. Sullivan.
L. D. Thorpe.
A. H. Tillson.
D. N. Tower.
W. H. Vaughn.
R. S. Weston.
F. I. Winslow.
G. E. Winslow.
I. S. Wood. — 57.

ASSOCIATES.

Harold L. Bond & Co., F. M. Bates and F. W. Mattheis.
Builders Iron Foundry, A. B. Coulters.
A. M. Byers Co., H. F. Fiske.
Carbic Mfg. Co., E. G. Frey.
Chapman Valve Mfg. Co., V. N. Bengle and C. E. Pratt.
Edson Mfg. Co., H. L. B. Watson.
Hersey Mfg. Co., W. A. Hersey and J. H. Smith.
H. Mueller Mfg. Co., Chas. J. G. Haas.
National Meter Co., H. L. Weston.
National Tube Co., H. T. Miller.
National Water Main Cleaning Co., B. B. Hodgman.
Pittsburgh Meter Co., J. W. Turner.
Rensselaer Valve Co., C. L. Brown, I. A. Rowe.
George H. Sampson Co., W. T. Page.
Thomson Meter Co., E. M. Shedd.
Union Water Meter Co., H. W. Jacobs, E. K. Otis.
Warren Foundry & Machine Co., W. F. Woodburn.
Water Works Equipment Co., W. H. Van Winkle.
R. D. Wood & Co., Charles R. Wood.
Worthington Pump & Machinery Corp., W. F. Bird, Samuel Harrison, E. P. Howard. — 27.

GUESTS.

MASSACHUSETTS.

Boston, G. A. Caldwell, F. W. Sears.
Haverhill, Frank G. Hamlin.
Onset, Silas L. Briggs.
Springfield, J. J. Fitzgerald. — 5.

Mr. Desmond FitzGerald, consulting engineer, Brookline, Mass., entertained the members with a talk on mountain scenery, beautifully illustrated with colored slides. Mr. James H. Mendell, superintendent of water works, Manchester, N. H., read a paper entitled, "The Past and Present Pumping Equipment of the Manchester Pumping Stations." Mr. R. C. P. Coggeshall, superintendent of water works, New Bedford, Mass., gave a brief description of an electrically driven unit recently installed at New Bedford. Mr. John C. Chase spoke of the early history of the Manchester, N. H., water works, with which he was connected in the early seventies.

Mr. Albert L. Sawyer, water registrar, Haverhill, Mass., read a paper entitled, "Recent Legislation and Decisions of the Courts with Reference to the Sanitary Protection of Water Supplies." The general subject was discussed by Mr. Percy R. Sanders, Mr. James H. Mendell, and Mr. Patrick Gear.

The President called upon Mr. McInnes for a report of progress from the Committee on Revision of Standard Specifications for Cast-Iron Pipe and Special Castings.

Standard Specifications for Cast-Iron Pipe and Special Castings.

Mr. Frank A. McInnes. My report is only in the line of informing the members in regard to the answers to the questionnaire which we sent out about two weeks ago. We have received several replies from the west coast, but I am sorry to say that comparatively few have been received from this neighborhood. Thus far, 88 replies in all have been received.

The first question on the questionnaire was, "Do you think a revision of the existing specifications desirable?" To this the answer has been "Yes" in 69 cases and "No" in 11 cases; that is, 86 per cent. of those who have answered have said "Yes."

To the second question: "Are you in favor of the adoption of uniform outside diameter?" 67 replies are "Yes" and 16 "No"; that is, 80.7 per cent. are "Yes."

To the third question: "Are you in favor of specifying chemical requirements of the metal?" The replies were 62 "Yes" and 17 "No"; that is, 78½ per cent. "Yes."

To the fourth question: "Are you in favor of a relation between flexure and breaking load?" 55 replies were "Yes" and 14 "No"; that is, 80 per cent. "Yes."

That is all I have to say, gentlemen. We were anxious to find out what the opinions of the members were, and so far as the replies have been received it looks as though there was to be more work for the committee to do.

The President. Your thought is that the committee will receive more answers to the questions you have sent out?

Mr. McInnes. Yes, I think there is no reason why the proportion of favorable answers should not continue.

The President. I think there is no doubt that the American Water Works Association will also send out a similar questionnaire after their May convention in St. Louis.

MR. PATRICK GEAR. We have about a thousand members, and according to the report which Mr. McInnes has given, showing that there have been 88 answers, I should say they would represent perhaps more than 50 per cent. of the membership. I answered for Holyoke and there are six members of the Association from Holyoke, and my answer is for the water department.

THE PRESIDENT. It seems to me that the time has been rather short, and doubtless there will be more replies.

MR. MCINNES. I think that is true, but I thought it would perhaps be interesting to the members to know what progress was being made, and it might stimulate other answers.

MR. GEORGE F. MERRILL. In connection with the specifications for cast-iron pipe, the thought occurred to me that possibly it would be wise to include some standard specifications for branch pipe, particularly for branch specials, elbows, and branches, which are made of different radius and length and different distances from center to center, for if any one has to deal with that class of work it is difficult to get competitive figures on the same details. Furthermore, many fittings of that kind are used around the pumps, and in case of a breakage it is difficult to obtain one on short notice. If these were standardized more, it seems as though it would be easier to obtain fittings that fit.

MR. HENRY A. SYMONDS. I think that, after considering the discussion at the last meeting relative to what should be the answers to these questions that our committee has sent out, we are more than ever impressed with the lack of knowledge of what are the real objections to carrying out the suggested changes. The manufacturers have taken an attitude that plainly implies that there are serious objections. This is a matter that has already been threshed out to a certain extent before the Association, but in reviewing the matter it was impressed upon my mind very forcibly that we have been practically told that, if the Association is to go ahead through its committee and revise the specifications as suggested, the consequences might be serious.

Now, in the face of statements of that kind I am at a loss to understand why the manufacturers will not come out frankly and tell us what they mean. There can be no question about the desirability of having uniform outside diameters and all the im-

provements which have been suggested in the changes in the specifications, if there are no serious objections. Now, are they going to be purchased at a great expense, or what does it mean? Can't we get some frank answer from the manufacturers to enable us to consider their interests and our own interests as users of cast-iron pipe, and see both sides of the question?

MR. MCINNES. I should like to say a word or two. Since this matter has been re-agitated within the last month or two months I have had representations from three, at least, of the most prominent manufacturers of pipe in the country, showing me — I don't know just how to express it — that there has been an unfortunate misunderstanding. I am very sure that there is no disposition or wish or desire on the part of the pipe manufacturers to do anything other than to give us full information. I am personally satisfied of that fact. Unfortunately there has been some misunderstanding, but I think we will have no difficulty in getting all the information we want.

THE PRESIDENT. I am glad the point has been brought up in the way it has been by Mr. Symonds, and I am glad to hear what Mr. McInnes has said in reply to it. It seems to me that if the manufacturers are not ready to state their position just now we might very well say that we will devote a portion of the next meeting to clearing up any misunderstanding there has been in the past, and that the manufacturers be asked to state at that time their position, if they feel that they haven't already made it clear, or if members of the Association feel that they have not succeeded in making their position clear. We should be glad to hear any representatives of the manufacturers to-day if they care to be heard, but if not to-day they can be ready at the next meeting to state their side of the case. The Secretary reminds me that there is no meeting between now and the fall convention, except the June meeting, which is usually more of a special meeting, so that possibly it would be well to hear from the manufacturers to-day. I will ask Mr. Wood if he has anything to say.

MR. WOOD. I don't think the manufacturers will have any objection to giving their reasons for objecting to certain things in the specifications; but, speaking for ourselves, we haven't anybody now who has time to go into it. That is a remark I made at

the meeting of the American Association and I was pretty sharply criticized for it, but I can't help making it. We have about twenty-five per cent. of the men we ought to have in our engineering department and drawing room, and I think most of the iron-pipe manufacturers are in the same condition. These things will have to be gone over very carefully, and I will say for ourselves that I think we can get something to submit to the committee regarding our own ideas on the subject between now and the time of the annual convention. But it is something that we have got to go over very carefully and fully, and it isn't anything that we can give an opinion on right off-hand. I don't mean to say that we haven't already had a lot of time, but we have had many other things to do.

THE PRESIDENT. What would you think of having a part of the time at the annual convention given up to this subject? Of course at that time we would have the benefit of any decision reached by the American Water Works Association.

MR. MCINNES. And I think it is possible that by that time the committee may have made some progress.

THE PRESIDENT. Then we will leave it in this way, with the hope that the committee and the manufacturers together may be able to make considerable progress between now and next September.

Mr. D. A. Heffernan, superintendent of the Milton water works, Milton, Mass., read a paper giving an account of his experiences in thawing out frozen services during the past winter. Mr. Patrick Gear, Mr. Wright, Mr. Frank A. McInnes, Mr. F. F. Forbes, Mr. Henry A. Symonds, Mr. R. C. P. Coggeshall, Mr. Frank L. Fuller, and Mr. A. E. Martin participated in the discussion, which culminated in the adoption of a motion made by Mr. McInnes that a committee be appointed to report, not later than at the annual convention, on the general subject of thawing frozen water pipes and collateral matters. The President said he would announce the members of the committee later.

Adjourned.

EXECUTIVE COMMITTEE.

Minutes of meeting of Executive Committee of The New England Water Works Association held at the rooms of the Association, Tremont Temple, Boston, Mass., March 13, 1918, at eleven o'clock A.M.

Present: President Carleton E. Davis and members Samuel E. Killam, Henry V. Macksey, Thomas McKenzie, Frank J. Gifford, A. R. Hathaway, and Willard Kent.

Messrs. Charles W. Sherman, Samuel E. Killam, and Frank J. Gifford were made a Committee of Arrangements for the June Outing.

A communication from the American Numismatic Society, of New York City, requesting a copy of the Brackett Memorial Medal, was presented and the subject was referred to Mr. Charles W. Sherman with the recommendation that the request be granted.

A copy of Digest of the electrolysis publication of the Bureau of Standards, compiled by Samuel S. Wyer, consulting engineer of Columbus, Ohio, was presented and recommended to the attention of the members at the meeting of the Association this day.

Discussion on the place of holding the next annual convention was held; final decision was deferred until further information could be obtained.

Adjourned.

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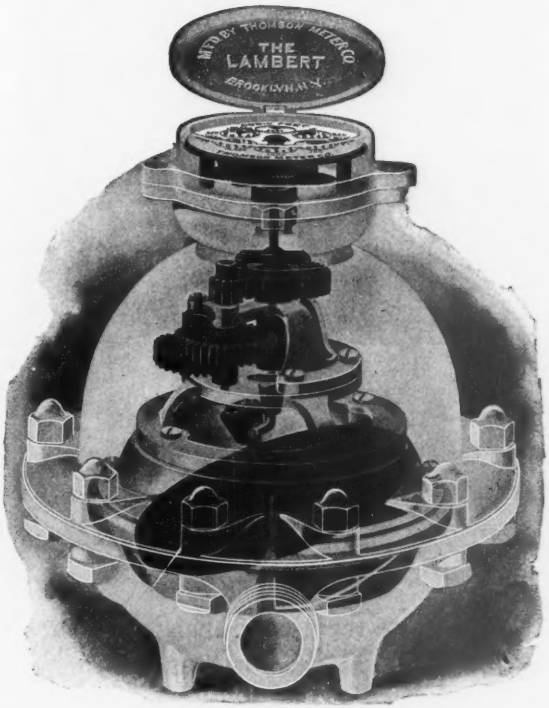

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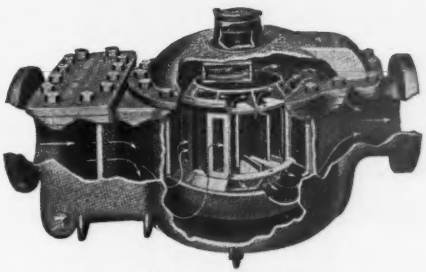

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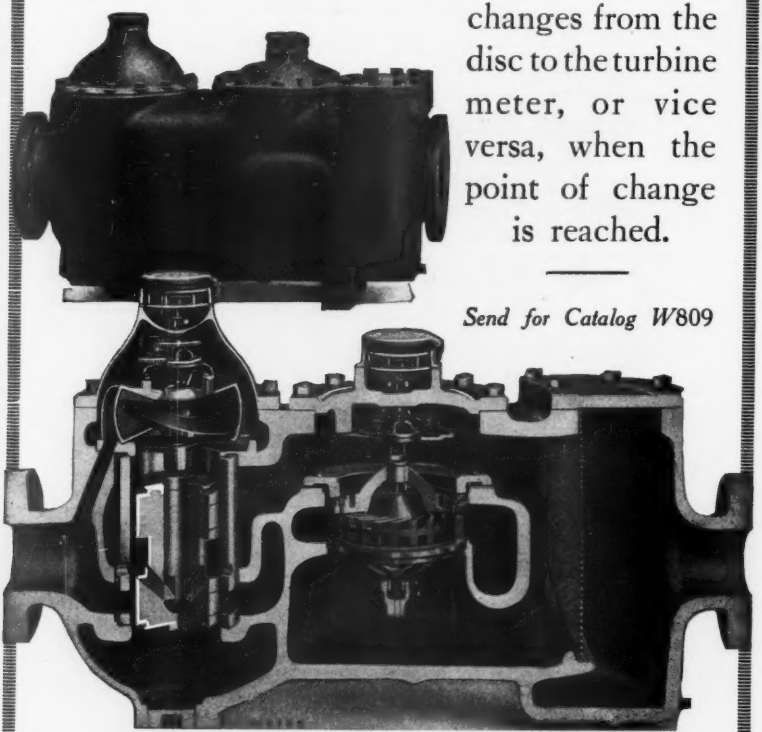

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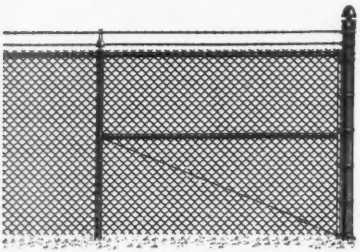

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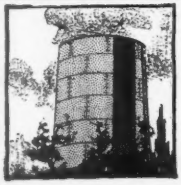

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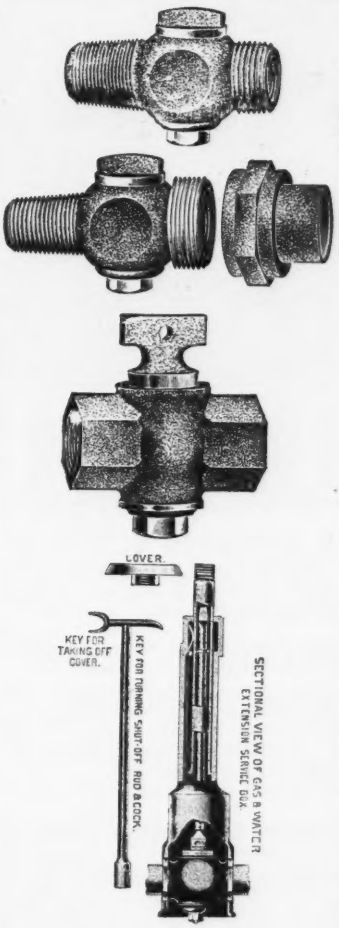

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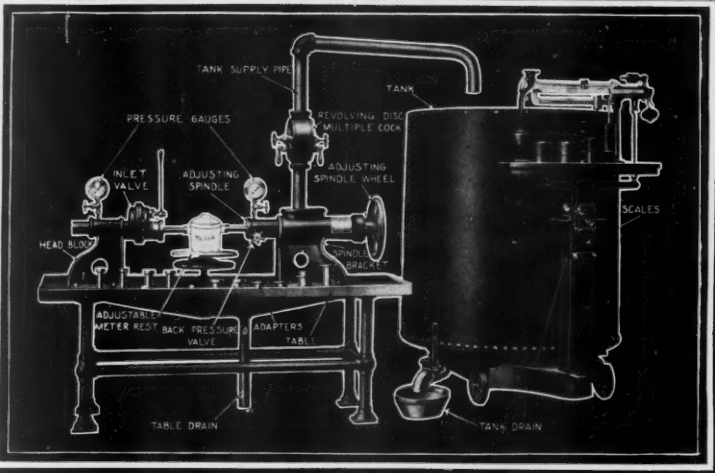

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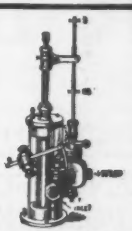

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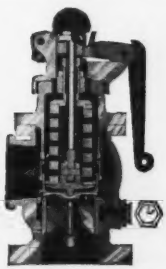

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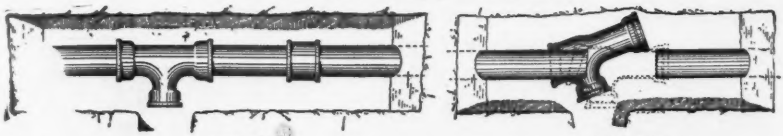

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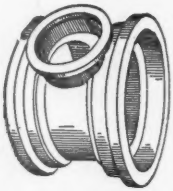

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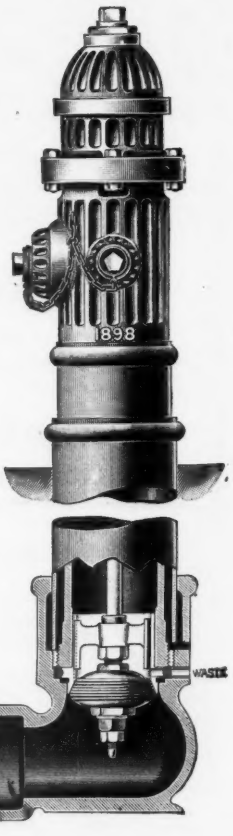

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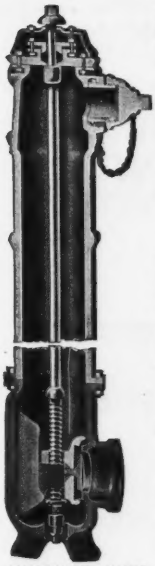

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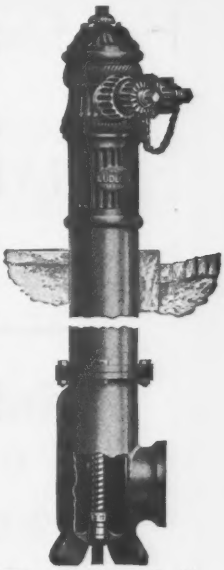

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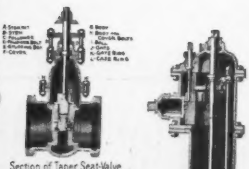
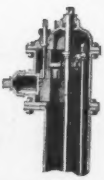
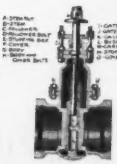


Section of Taper Seat-Valve.



Hydrant with Independent Nozzle Cut-off.



Section of Parallel Seat-Valve.

Section of Vertical Check-Valve.

Section of Vertical Foot-Valve.

Horizontal Check-Valve.

Vertical Foot-Valve.

Hydrant with Water Crane Attachment.

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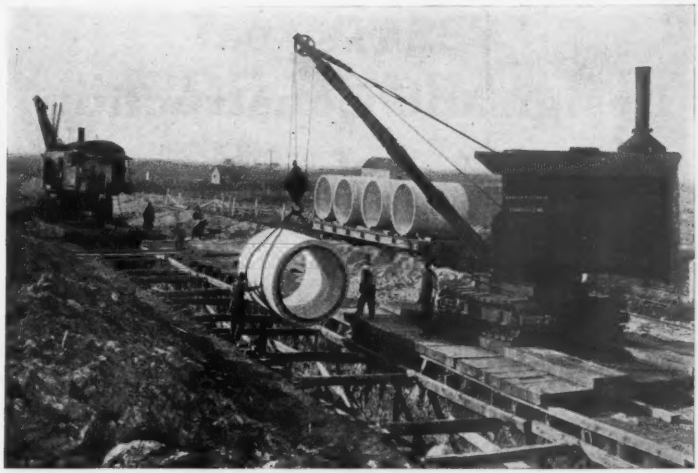

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I am.....*years of age, and I have been engaged in the following named work:*

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Signed,.....

Address,.....

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Sept 1918

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